# DOES THE FUTURE ENGINEER FORCE TRANSITION ENGINEER UNITS BETWEEN OFFENSIVE AND STABILITY OPERATIONS IN WAYS THAT ACHIEVE RESPONSIVENESS, VERSATILITY, AGILITY, EFFECTIVENESS, AND EFFICIENCY?

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MASTER OF MILITARY ART AND SCIENCE
General Studies

by

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**14. ABSTRACT**

The purpose of this thesis is to assess the effectiveness of Future Engineer Force (FEF) transitions between full-spectrum operations. The research question is, Does the FEF transition engineer units between offensive and stability operations in ways that achieve responsiveness, versatility, agility, effectiveness, and efficiency? The transition to and execution of stability operations during Operation Iraqi Freedom (OIF) posed significant challenges for the Engineer Regiment. This thesis identifies these challenges and uses them to compare the forces that executed the initial thirty to sixty days of OIF stability operations to the FEF. The research found that FEF solutions to OIF challenges were better than solutions derived by the units that served in OIF. However, the FEF can improve by addressing training shortfalls and mitigating the ramifications of not having an organic engineer battalion commander in each brigade combat team.

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# ABSTRACT

DOES THE FUTURE ENGINEER FORCE TRANSITION ENGINEER UNITS BETWEEN OFFENSIVE AND STABILITY OPERATIONS IN WAYS THAT ACHIEVE RESPONSIVENESS, VERSATILITY, AGILITY, EFFECTIVENESS, AND EFFICIENCY? by Maj David T. London, 125 pages.

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## ACRONYMS

| | |
|---|---|
| BCT | Brigade Combat Team |
| BCTs | Brigade Combat Teams |
| DPW | Department of Public Works |
| CGSOC | Command and General Staff Officer Course |
| COE | contemporary operating environment |
| ENCOM | Engineer Command |
| FEF | Future Engineer Force |
| FEST | Facilities Engineering Support Team |
| FM | Field Manual |
| METT-TC | mission, enemy, terrain, time, troops available, and civil considerations |
| OIF | Operation Iraqi Freedom |
| OIF-F | Operation Iraqi Freedom Force |
| OPCON | operational control |
| RPMA | real-property maintenance activities |
| RSOI | Reception, Staging, Onward Movement, and Integration |
| SWEAT | sewer, water, electrical, and trash |
| UAV | unmanned aerial vehicle |
| UE | Units of Execution |
| UEx | Unit of Employment x |
| UEy | Unit of Employment y |
| USACE | United States Army Corps of Engineers |

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# CHAPTER 1

# INTRODUCTION

> Throughout the campaign, offensive, defensive, stability, and support missions occur simultaneously. As missions change from promoting peace to deterring war and from resolving conflict to war itself, the combinations of and transitions between these operations require skillful assessment, planning, preparation, and execution. (FM 3-0 2001, 1-16)
>
> U.S. Army, *Operations*

## Background

On 1 May 2003, the United States military declared an end to major combat operations in Operation Iraqi Freedom (OIF). V Corps, I Marine Expeditionary Force, and their subordinate maneuver units completed their ongoing transition from offensive to stability operations. The mobility, countermobility, and survivability focus of their organic and embedded combat engineer commanders quickly shifted to general engineering and fight as infantry missions. In Iraq's capital city of Baghdad, United States military ground commanders needed electrical grids turned on, water and sewage infrastructure repaired, trash pickup initiated, power plants secured, and street maintenance and repair executed. These missions fell on the combat engineer battalion and brigade commanders that had spent the previous six months training their units almost solely on breaching obstacles, crossing rivers, and integrating corps and higher echelon engineering assets into mobility support tasks (Peabody 2005a). The offensive fight was the priority for the United States Army in OIF and it was an overwhelming victory. The United States Army transition to and execution of stability operations had a different level of success.

Since the declared end to major combat operations in OIF, the Army has stood up more than twelve modular brigade combat teams (BCTs) and at least four modular units of employment x.[1] The United States Army Engineer Regiment is likewise converting to the Future Engineer Force (FEF).

## Primary Research Question

The purpose of this thesis is to assess the effectiveness of FEF transitions between operations. The guiding question is, Does the FEF transition engineer units between offensive and stability operations in ways that achieve responsiveness, versatility, agility, effectiveness, and efficiency? Definitions of terms helpful to understanding this question are listed in the glossary. To answer this question, background and context will first be established.

## Background

As full-spectrum operations transition between offensive and stability operations, brigades and divisions require significantly different engineering capabilities. Normally, offensive operations require a high proportion of combat engineering capability, while stability operations require a high proportion of general engineering capability. During OIF, offensive operations continued long past the officially declared end to combat operations. The reality that engineer commanders had to simultaneously support offensive and stability operations in OIF demonstrates the need for FEF units to anticipate similar requirements in future operations. The problem lies in achieving the appropriate mix of engineering capabilities when transitioning between offensive and stability operations. This problem has many facets.

The first facet is how to get the right mix of engineering capabilities into theater to support a campaign. Achieving the right “theater mix” begins with identifying the baseline engineering mission requirements during theater campaign planning. This baseline requirement cannot anticipate all possible scenarios and subsequent mission demands. However, it can and does serve as a foundation for force allocation. Once the proper theater mix is determined, timely arrival of engineering modules becomes a matter of strategic mobility planning.

The second facet surfaces as the campaign transitions between offensive and stability operations. The problem here is how to get the right engineering capability to the right place on the battlefield at the right time. Given the fluid nature of combat operations, commanders cannot precisely anticipate transitions between offensive and stability operations in time to achieve the optimum mix of engineering capabilities to satisfy requirements of the new phase. As a result, required engineering modules may be separated from the required location by great distances within theater, road network congestion, or competition for scarce operational lift assets such as heavy equipment transport trucks. The required engineer units might not even be in theater. Achieving the optimum engineering capabilities mix during and after transition becomes a mission prioritization, command and control, strategic mobility, and operational mobility challenge.

A third facet appears when planners are unable to overcome the first two facets. How does the commander on the ground handle a situation where the “right” engineering capability is unavailable, but other engineering capabilities are present? For example, when 3rd Infantry Division transitioned from offensive operations to stability operations

in Baghdad, it did not possess the doctrinally appropriate engineering capabilities to meet infrastructure repair requirements. Its organic engineer commanders were called on to meet those requirements. Combat engineering Soldiers are trained to breach minefields, emplace obstacles, and improve unit survivability. They do not receive any training to enable them to operate or repair the electrical power grid for a city of five million people. How should the combat engineer commander prepare for such a possibility? An engineering unit's ability to accomplish the mission under such circumstances is largely a training challenge.

These are the background and context that frame the guiding question of this thesis: Does the FEF transition engineer units between offensive and stability operations in ways that achieve responsiveness, versatility, agility, effectiveness, and efficiency? To answer the guiding question, this thesis will compare the quality of transition achieved by the forces that executed the first thirty to sixty days of OIF stability operations to the potential quality of transition the FEF could provide.

## Secondary Research Questions

The strategy of this thesis is to address the thesis question by answering five secondary questions:

1. What discrete capabilities do combat and general engineering units each bring to the warfighter?

2. Who decides the priority of combat engineering and general engineering capabilities allocation and apportionment?

3. What organization(s) provide command and control to non-organic engineer units?

4. Do engineer units possess sufficient strategic and operational mobility to achieve assured mobility in today's contemporary operating environment (COE)?

5. Does engineering unit training adequately prepare engineer units to be effective in combat?

Figure 1 depicts the research question and secondary questions. Each question is explained in the succeeding paragraphs.

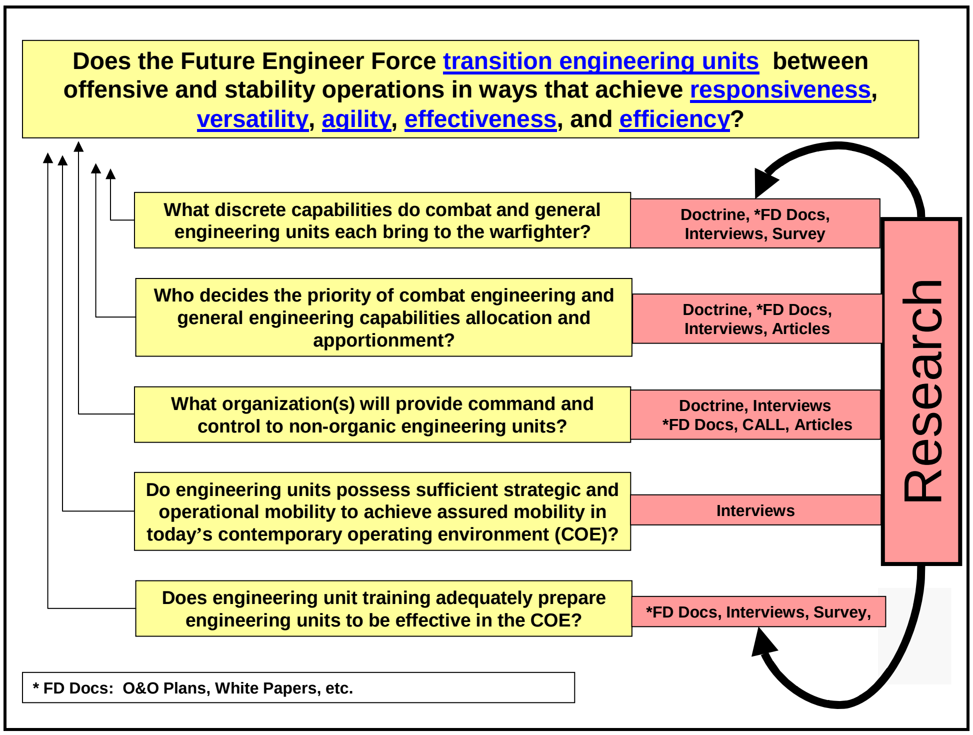


Figure 1. Thesis Question and Strategy

What discrete capabilities do combat and general engineering units each bring to the warfighting commander? There is a reason for having these two different types of engineer units. What is that reason and does it represent a rigid wall between the two engineering types? What is the mix of engineering capabilities required for offensive

operations and the mix required for stability operations? Finally, what engineering capabilities mix did the Engineer Regiment actually employ in OIF?

The next task is to determine who sets the priority of engineering support within the theater and within each area of operations. Knowing that there is a finite number of engineering modules in a theater, who decides whether combat and general engineering units will support decisive operations, shaping operations, or sustaining operations? Likewise, how will the FEF apportion forces between the brigade combat team, the theater support command, and other support units of action?[2] Once apportioned, who will increase the sustainment capabilities of the gaining unit to support the "plug and play" engineering modules? As engineering module apportionment is examined, effective use of those engineer units must also be measured. What proportion of engineering missions in OIF were outside of the traditional missions of mobility, countermobility, survivability, and general engineering? Specifically, how frequently have OIF engineer units executed their secondary mission to fight as infantry? Once the commander determines the priority of engineering support, he must assign it a command and control structure.

Who provides command and control to non-organic engineering modules? The Army's Modular Force has brigade troops battalions, maneuver enhancement brigades, units of employment x, and the expeditionary engineer brigade. How does the commander determine when each structure should provide command and control to engineer units moving throughout the theater of operations? A deeper question is, how much engineering combat power can each of these command and control structures handle? Also, who provides sustainment to the engineering modules as they move

between intra-theater areas of operation? How quickly and efficiently will the logistics tail left in the old intra-theater area of operation move to the new intra-theater area of operation? Movement between intra-theater areas of operation begs the question of operational mobility.

Does the FEF possess sufficient strategic and operational mobility to achieve assured mobility in today's COE? How will the unit of employment y and the maneuver enhancement brigade "stock" engineering modules in theater and throughput those modules from ports and staging areas to required locations? Where are the engineering staging areas located? Will there be dedicated line haul assets available to move engineering modules or will they primarily conduct tactical road marches? A significant factor will be the pace of the operational transition itself. Do such transitions happen over a matter of hours, days, weeks, or longer? What are some examples of sister service engineer units fulfilling Army engineering roles during OIF? Once the answers to strategic and operational mobility are found, the next task is to determine the preparedness of engineer units to execute the mission upon arrival.

How does the Engineer Regiment train engineering modules to be effective in combat? How do engineer units plan and prepare for new missions when time is constrained? For example, when an engineering module is unexpectedly pulled from shaping or sustaining operations to support decisive operations, how does the engineer commander plan for the new mission? What is the cost to the engineer commander of units planning in such a time-constrained environment? What is the engineer commander to do when the right module is not on the ground, but his engineer units are? How should the engineer commander prepare his unit to operate outside its doctrinal mission set?

How mutually exclusive are the combat and general engineering missions? What combat and general engineering tasks are resident in Army of Excellence engineer units and the Army Future Force? What examples from history illustrate combat and general engineering units crossing the "boundary" of mission separation?

## Assumptions

1. It is a fact that the national command authority disapproved the deployment of a robust general engineering package for OIF. This thesis assumes that if the FEF been available for deployment to OIF-1, the national command authority would have similarly disapproved the deployment of a robust general engineering capability prior to the start of the ground war. Therefore, the task organization of the FEF in this research project will be as close as possible to the task organization of the OIF-1 engineering force.

2. The reader has a basic understanding of both Army of Excellence doctrine and the structure of the Army's Modular Force. Therefore, there will not be a limited discussion of Army of Excellence doctrine and FEF concepts.

3. The manpower-intensive demands of OIF, the statutory regulations that will soon limit the size and frequency of Reserve Component units, and the current Army initiative to rotate units through OIF present pressures that may cause fewer capabilities to be deployed in order to meet identified mission requirements. While the national command authority is committed to fulfilling as many mission requirements as possible, Army units--to include engineer units--will have to fill many requirements with fewer units than desired.

## Limitations

Several limitations will impact the scope and analysis of this research.

1. Time: The researcher is simultaneously completing this thesis and attending classes as a resident of the Command and General Staff Officer Course (CGSOC). Many aspects of the research question cannot be analyzed in sufficient depth. Additionally, research was not exhaustive. There are undoubtedly a large number of relevant articles and literature that the researcher did not find and therefore did not integrate into this analysis.

2. Lack of research experience: This is the first time this researcher has undertaken project of this scope. This caused some actions to be repeated several times and other actions to be rushed.

3. Limits of practical experience: The researcher did not serve in OIF and has limited assignment experience with general engineering units and light infantry units.

4. Limited information available: The challenges this thesis focuses on are not all-inclusive. They reflect information available to the researcher during the data collection period. While the selected commanders identified the majority of challenges, the researcher is unable to assess how widespread these challenges were in Iraq's many areas of operation.

5. Telephone Interviews: Interview subjects were encouraged to tell their story in their own words. While standard questions were prepared and presented to the interview subjects, not all questions were answered. The researcher took license to consolidate trends in the interviews to determine both the challenges that faced engineer units during OIF and the solutions commanders employed. Additionally, interviews conducted by

phone were not recorded and therefore the potential exists for error in transferring interview results into this document.

6. FEF references: Decisions impacting the design and capabilities of the FEF are being made weekly. Most FEF decisions and concepts have not yet been codified into doctrine. The information presented in this research project represents only what could be documented by official sources. It may lag behind the latest decisions.

7. Subjective assessments: The assessments of how effective the units that served in OIF were and how effective FEF units would be in a similar environment will be subjective. They are based on researcher lessons learned during the preparation of this thesis, opinions of interviewed commanders, and the previous operational experience of the researcher.

8. Potential for bias in surveys: The survey of CGSOC students was not a random sample. Due to the low number of OIF veterans, the researcher elected to survey all engineering officers regardless of OIF experience.

9. Bias in interpreting doctrine and FEF concepts: The application of doctrine and FEF concepts reflects the experiences and perspectives of the researcher. Other experienced personnel might have elected different methods or arrived at different conclusions as a result of the analysis.

## Delimitations

1. The research scope will focus on mechanized units in Baghdad and the western Iraqi province of Al Anbar.

2. Every attempt will be made to correlate the feedback of the various interview subjects to achieve an objective assessment of OIF solution quality.

## Scope

The scope of this research project includes engineering support to the ground offensive phase and the stability operations phase of OIF-1, with particular emphasis on the stability operations phase. Ground offensive operations began on or about 20 March 2003 (Fontenot et al. 2004, 87). The transition to stability operations occurred at different times for each theater area of operations. In Baghdad, it happened with the collapse of Saddam Hussein's regime on or about 10 April 2003 (Fontenot et al. 2004, 339). Stability operations continue even today. This thesis will focus on the first thirty to sixty days of stability operations.

The intent of this thesis is not to write a history of engineer units that served in OIF. The purpose for including selected unit actions is to illustrate general trends in how engineer units overcame challenges during OIF-1. The reader can consult the United States Army Military History Institute or the individual units to obtain detailed unit histories.

## Significance

At the time of this writing, the FEF is moving from concept to reality on a very accelerated timeline. There are several articles and official documents that describe the FEF. Most works identified by the researcher describe the strengths, capabilities, and proper employment of the FEF. The researcher did not find any works that address potential FEF shortcomings. The intended contributions of this thesis are to provide critical analysis of the FEF and present recommendations for improving it.

## Summary

Chapter 1, "Introduction," presented background, context, and expansion on the thesis question: Does the FEF transition engineer units between offensive and stability operations in ways that achieve responsiveness, versatility, agility, effectiveness, and efficiency? This thesis will answer the research question by comparing the quality of transition achieved by the units that conducted the first thirty to sixty days of OIF stability operations to the quality of transition that could be achieved by the FEF. Chapter 2, "Literature Review," will summarize existing research relevant to the thesis question.

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[1] At the time of this writing, the United States Army is beginning to adopt a modular force structure. Brigade-sized maneuver units now have their combat multipliers as organic members of their formation. These brigade units are called units of action or brigade combat teams. The next higher echelon of command is called a unit of employment x and provides command and control to between seven and eleven subordinate brigade-sided elements.

[2] Another component of the Army's Modular Force is that BOS enablers are often concentrated in a tailorable brigade-sized unit. These are called support units of action and include the Maneuver Enhancement Brigade, Fires Brigade, Aviation Brigade, Sustainment Brigade, the Expeditionary Engineer Brigade, and Battlefield Surveillance Brigade.

# CHAPTER 2

## LITERATURE REVIEW

> Operation Iraqi Freedom was and is an engineer's war. During the fight, and even more now, the engineers are critical. We cannot do without the engineers. (Martin 2003, 12)
>
> Major General Walt Wojdakowski
> Deputy Commanding General, V (U.S.) Corps

Chapter 1 described the research question, its secondary and tertiary questions, and the scope of this research project. The purpose of this chapter is to briefly summarize the major themes of relevant existing literature in order to establish a foundation for the research question. This chapter will also identify gaps in current literature in order to show the contribution this work makes to the topic. The chapter begins with an explanation of the research project's intended contributions. It will then present a synopsis of existing works relevant to the research topic in three broad categories: (1) OIF engineering operations, (2) the FEF, and (3) Army of Excellence doctrine.

As stated in chapter 1, the FEF is rapidly evolving, and there are a large number of publications that describe it. However, these works focus on the strengths and capabilities of the FEF and not on its potential shortcomings in meeting the challenges of the COE. The intended contributions of this thesis are to provide critical analysis of FEF effectiveness and convey recommendations for improvement. The challenges engineer units faced during OIF will be the identical challenges the FEF will be evaluated against in this research endeavor. Additionally, the Army of Excellence doctrine--Air Land Battle--was the official doctrinal solution to many OIF challenges. The relevant literature

for this thesis will therefore cover OIF engineering operations, the FEF, and Army of Excellence doctrine.

## OIF Engineering Operations

The focus of this research project is engineering operations in support of the ground offensive phase and the first thirty to sixty days of the stability phase. During the offensive fight, organic and embedded engineer units supported 3rd Infantry Division (Mechanized), 101st Airborne Division, and 82nd Airborne Division (Martin and Johnson 2003, 5). They executed breaching, bridging, minefield reduction, explosive hazard mitigation, construction and repair of lines of communication, airfield repair, and provided geospatial products (Koenig 2004, 21). As engineer units transitioned to stability operations, fight as infantry missions and general engineering missions became more common. City infrastructure such as power and water stations became “key terrain” to gain the support of local Iraqi civilians (Reyes 2004, 3). In the first thirty to sixty days, the infrastructure repair missions required in Baghdad and other major Iraqi cities largely fell upon combat engineering units organic to the forward divisions. The challenges involved with the general engineering and fight as infantry missions will be described in chapter 4, “Analysis.” The following paragraphs describe the FEF.

## The Future Engineer Force

### Introduction

The Modular Force is the term describing the Army’s modular formations. There are three basic types of units in the modular force: “units of execution (UEs) X and Y, and BCTs. BCTs are stand-alone combined arms organizations. There are three types of

BCTs: heavy, infantry, and Stryker. UExs exercise command and control of Army forces at the tactical- and operational-levels. Army components at theater level are organized as UEys. In addition, specialized brigades may be assigned to both UExs and UEys when the situation requires their capabilities" (U.S. Army 2004a, viii).

The FEF is a modular organization that is adaptable based on METT-TC and capable of augmenting maneuver BCTs, support BCT and the UEx. Engineer brigade commanders have the ability to provide technical staff elements or entire mission engineer battalions. The Modular Force adaptable design will allow a maneuver or support BCT to reintegrate an engineer battalion from the UE. This engineer battalion is equipped with the same common operational picture and thus will allow the BCT to fully integrate the battalion and collaboratively plan before the engineering unit arrives at the link up point. The engineer brigade is a standing headquarters capable of interdependency with a joint force (FEF O&O 2004, 55).

## Maneuver Enhancement Brigade

The maneuver enhancement brigade will be discussed in greater detail because of its role in the employment of engineers. The FEF will have forward support company with modular, tailored forward maintenance teams providing the capability to conduct maintenance, vehicle recovery, medical, and sustainment tailored to fit the specific units needs The UEx, UEy, BCTs, and maneuver enhancement brigade all contain engineers on their staffs. The UEx headquarters and maneuver enhancement brigades contain more robust engineering staffs than the BCTs because of their role in engineering planning and employment (FEF O&O 2004, 64). The maneuver enhancement brigade is the primary conduit for employing engineering forces in support of the UEx above the embedded

Engineer forces within the Maneuver BCT. The maneuver enhancement brigade is a standing headquarters , commanded by a branch immaterial colonel, with no organic forces (FEF O&O 2004, 69). The following paragraphs explain the organic designs of embedded, baseline, and mission forces of the FEF as shown in figure 2.

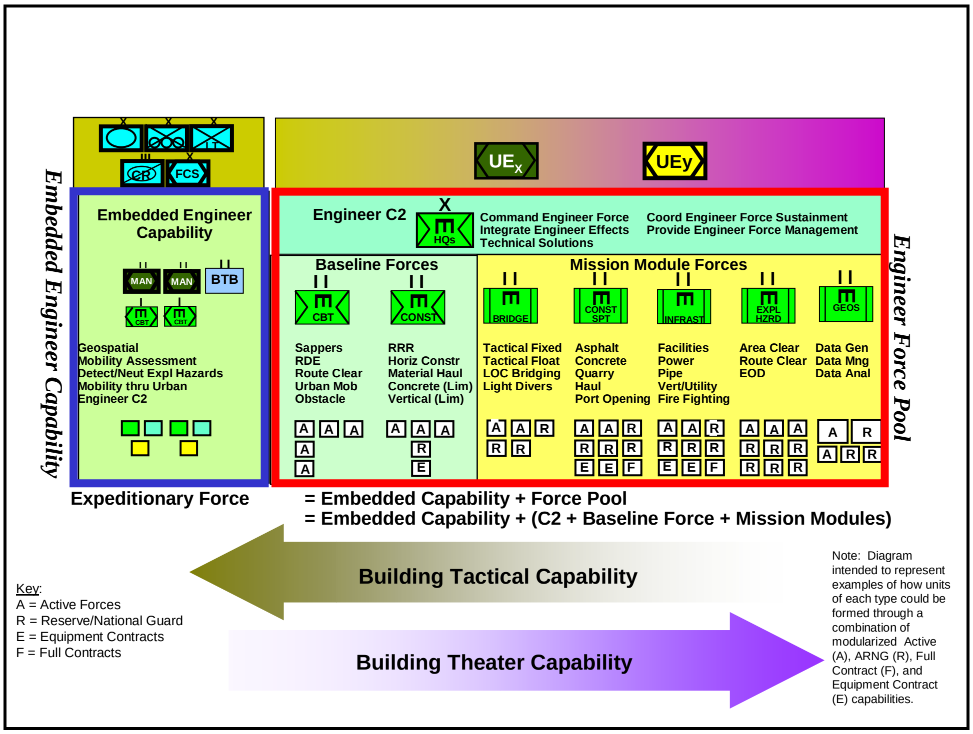



Figure 2. Embedded, Baseline, and Mission Force Structure

*Source*: U.S. Army, 2004g, TRADOC Pam 525-3-34, The FEF operational and organizational concept (Draft) (Fort Leonard Wood, MO: U.S. Army Training and Doctrine Command, U.S. Army Engineer School), 56.

Embedded, Baseline, and Mission Forces

"Embedded engineering forces" are engineering forces or technology that are organic to a combat formation (brigade or battalion). They are unique to the type of maneuver BCT or maneuver task force they are supporting and provide a minimum level

of the most critical or most frequently required engineering capabilities. A key point is this design does not have the battle command capacity to receive augmentation of additional engineering forces above the unit level unless additional command and control elements accompany this augmentation. In a heavy BCT, these units consist of an engineer company in each of the subordinate combined arms battalions. Each company has three armored combat earthmovers, two small equipment excavators, two vehicle launched mine layers, and nine M2A3 Bradley Fighting Vehicles (FEF O&O 2004, 72).

The very nature of the embedded design drives the design of the baseline engineering forces. The baseline engineering design combines engineering battle command with a baseline of organic engineering effects forces. It serves as the primary building block for projecting engineering mission forces to accomplish tactical or operational missions and also provides an early entry engineering capability. However, this unit receives, and depends upon, units from the force pool design for mission specific capabilities (FEF O&O 2004, 73). Some of the unit types in the baseline force include:

1. The Engineer Battalion Headquarters: plans, integrates, and directs the execution of engineering missions conducted by any mix of supporting engineering companies to provide mobility in support of force application or focused logistics

2. The Sapper Company: executes mobility, countermobility, and survivability tasks, and provides support of general engineering missions

3. The Mobility Augmentation Company: conducts assault gap crossings, mounted and dismounted breaches, and emplaces obstacles

4. The Clearance Company: conducts detection and neutralization of explosive hazards along routes and within areas in support of support brigades to enable force application, focused logistics, and force protection

5. The Engineering Mine Dog Detachment: provides battle command for five mine dog squads as well as coordinate their activities and missions with higher headquarters

6. The Engineer Support Company: provides battle command of engineering platoons that augment the early fight. Capable of accomplishing missions including rapid runway repair, initial base camp construction, non-explosive obstacle breaching, non-explosive area clearing, constructing tactical unmanned aerial vehicle airfields, hasty landing zones, and assault landing zones

7. The Horizontal Construction Company: provides battle command of engineering effects platoons that are necessary to conduct missions such as repair, maintain, construct air and ground line(s) of communication; emplace culverts; hauling; force protection; and limited clearing operations

8. The Vertical Construction Company: executes general engineering missions to construct base camps, internment facilities; construct, repair, maintain vertical infrastructures in support of support brigades or engineer brigades (FEF O&O 2004, 74-92).

Mission specific forces primarily provide engineering effects units required by baseline forces to respond to specific, changing missions. This organization is adaptable from squad to company sized and provides a maximum commonality of design. This is a fixed organization with discrete sets of capabilities that are scalable yet robust. The

mission specific forces can serve as an engineering mission force when necessary and may have a mix of active forces, reserve forces, equipment contracts, or full contracts. engineering mission forces include:

1. Multirole Bridge Company: provides personnel and equipment to transport, assemble, disassemble, retrieve and maintain all standard United States. Army bridging systems.

2. Dive Team Heavy: supports a UEy in support of engineer brigade commanders in ports, harbors, and coastal zones.

3. Dive Team Light: provides light diving support to the engineer brigade commander in the areas of offense, defense, and post-conflict operations.

4. Engineer Company, Prime Power Battalion: generates electrical power and provides advice and technical assistance on all aspects of electrical power and distribution in support of military operations.

5. Fire Fighting Teams: provide command, control, and coordination of engineering fire fighting teams.

6. Pipeline Company: provides technical personnel and specialized equipment to assist the horizontal construction companies or construction units in constructing, rehabilitating, and maintaining pipeline systems.

7. Engineer Well Drilling Detachment: provides battle command, coordination and limited requisitioning of unique repair parts and other supplies for well drilling teams.

8. Facilities Engineer Detachment: provides Department of Public Works (DPW) bare base facilities management for troop concentrations in a theater of operations, design

solutions for minor facility repair and maintenance facilities, environmental assessments, and remediation expertise.

9. Real Estate Team: provides real estate teams for performing functions related to the acquisition, utilization and disposal of real property for military purposes.

10. Survey and Design Team: provides construction and geodetic survey in developed and undeveloped theaters of operation. Create detailed construction plan drawings and “as-built” drawings. Conduct material testing and analysis, for example, soils, concrete, and asphalt to support design, quality assurance, and quality control for construction. Conduct specific geodetic survey of potential air bases in theater. Establish third order geodetic control in undeveloped theaters

11. Explosive Hazard Coordination Detachment: enables the land component commander to predict, track, distribute information on, and mitigate explosive hazards within the theater that affect force application, focused logistics, force protection, and battlespace awareness. Establishes and maintains an explosive hazard database, conducts pattern analysis, investigate mines, improvised explosive devices, or unexploded ordinance strikes or hazards areas. Provides technical advice on the mitigation of explosive hazards including the development of mitigation, avoidance and neutralization techniques, tactics, and procedures and provide training updates to field units. Conduct hazard neutralization when required.

12. Explosive Hazard Team: provides evaluation of explosive hazards incident site(s) in support of support BCTs, maneuver BCTs, and brigade sized units and smaller. Conducts limited neutralization of explosives hazards. Conducts training for brigades and joint, interagency, multinational personnel on explosive hazards mitigation, avoidance,

and neutralization techniques, tactics, and procedures in a joint operations area. Augment the explosive hazards detachment already deployed in theater to give the deployed force more explosive hazard teams at the BCT or support Brigade level based on METT-TC.

13. Topographic Company: collects and provides updated geospatial data to theater Army service component command headquarters or joint task force. Performs analysis, manages, and disseminates geospatial information to supported units. Provides digital geospatial data and databases for planning and execution. Finishes compilation of geospatial data into terrain products. Prints overlays, and hardcopy geospatial products. Geospatial force provider for theater level Joint command, rotational deployments, and coalition allies at the UEy level (FEF O&O 2004, 98-119).

## Assured Mobility

Providing assured mobility to the maneuver commander is a critical imperative of the FEF. Assured mobility "[guarantees] the force commander the ability to deploy, move, and maneuver where and when he desires, without interruption or delay, to achieve his intent. This includes maneuver in all types of terrain and weather, including urban terrain" (Read and Kerley 2003, 12). The engineering plan for OIF was based on the emerging doctrine of assured mobility (Martin and Johnson 2003, 5). Assured mobility concentrates on two interrelated components: freedom of maneuver and force protection. It uses current and developing technologies to leverage the collection and analysis capabilities of the force. Assured mobility then predicts enemy actions that can hinder friendly mobility and takes proactive measures to render those enemy actions ineffective. This predictive ability enables to commander to alter his maneuver plan to avoid known impediments, or neutralize those impediments that cannot be prevented or avoided (Read

and Kerley 2003, 12). Assured mobility uses superior situational understanding, shared knowledge, and decisive execution to identify actions that can sustain friendly maneuver and those that can preclude enemy maneuver. See figure 3.

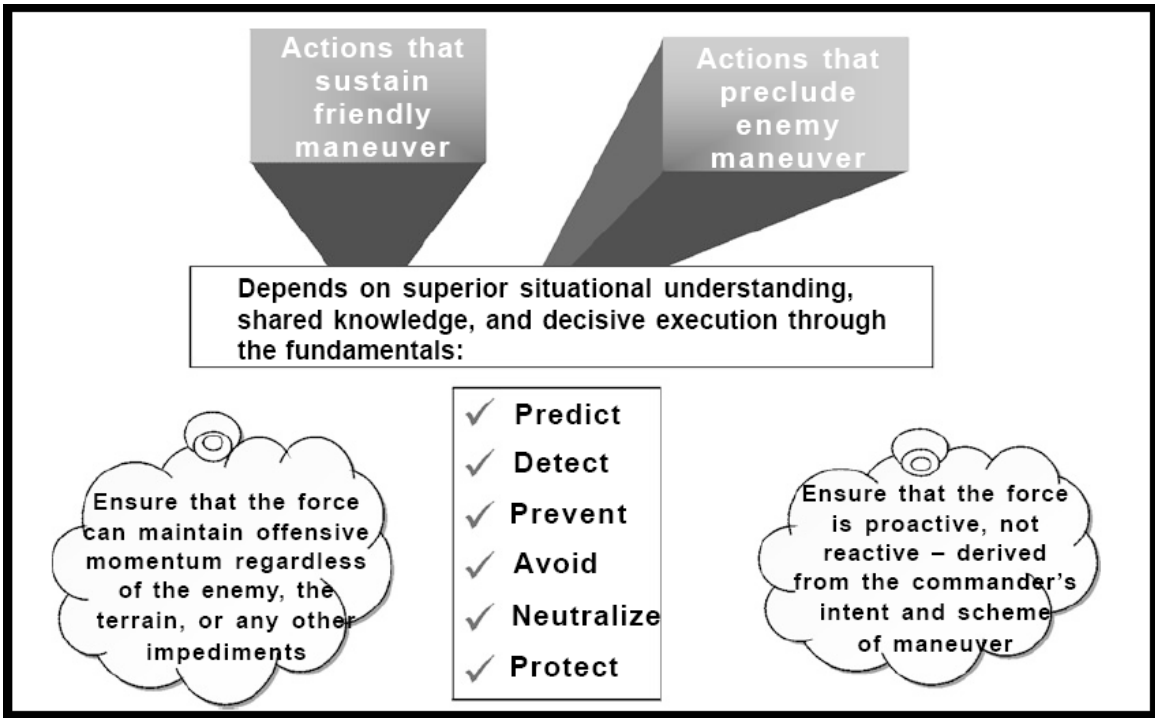



Figure 3. Assured Mobility

*Source*: Jeffrey Bedey and Ted Read, 2003, Operationalizing Assured Mobility, *Engineer Magazine*, April-June, 15.

## Army of Excellence Doctrine

This section will doctrinally define offensive operations and stability operations. It will also describe engineering capabilities and the doctrinal ways that engineer units organize to provide capabilities in support of offensive and stability operations.

## Offensive Operations

Field Manual (FM) 3-0, *Operations*, defines the offense as, “the decisive form of war. Offensive operations aim to destroy or defeat an enemy” (2001, 7-2). Their purpose is to impose the United States will on the enemy and achieve decisive victory. Offensive operations take place in all types of terrain and environments and are generally directed against an organized enemy that employs some sort of tactical formation. At the tactical level, friendly forces combine fire, maneuver, and the other elements of combat power to exploit an enemy flank or weakness in order to render the enemy formation incapable of further military action. Stability operations are less precisely defined and characterized.

## Stability Operations

FM 3-0, *Operations*, states that, “Stability operations promote and protect US national interests by influencing the threat, political, and information dimensions of the operational environment through a combination of peacetime developmental, cooperative activities and coercive actions in response to crisis” (2001, 1-10). Stability operations can take place as the decisive operation of a military campaign or as a subordinate phase of a major theater war or smaller scale contingency. Like offensive operations, stability operations are generally directed against an organized enemy. However, that enemy does not normally employ tactical formations to combat friendly forces. Instead, the enemy seeks to erode friendly combat power through a wide range of options that include terrorism, information operations, insurgency, counterinsurgency, and guerrilla tactics aimed at military, civilian, local, and international targets. When compared to offensive operations, stability operations require friendly military forces to be more dependent upon joint, interagency, multinational assets. At the tactical level, friendly force

employment of combat power requires a considerately different array of capabilities and task organization. This has significant implications for engineering organization.

## Discrete Engineer Capabilities

The Engineer Regiment brings significant capabilities to the warfighting commander. These succeeding sections will overview those capabilities and identify the engineering requirements of offensive operations and stability operations. The three primary engineering battlespace functions are combat engineering, comprised of mobility, countermobility, and survivability; geospatial engineering; and general engineering (FM 3-34 2004, 3-1). Combat engineering units also have a secondary mission to fight as infantry. The succeeding paragraphs overview the primary engineering battlespace functions.

### Combat Engineering

Combat engineering is focused on the support of close combat forces. "Combat engineering units enhance the force momentum by physically shaping the area of operations to make the most efficient use of space and time to generate mass and speed while denying enemy maneuver" (FM 3-34 2004, 3-2). Combat engineering includes the subordinate functions of mobility, countermobility, and survivability.

The mobility function entails obstacle reduction by maneuver and engineer units to reduce or negate the effects of existing or reinforcing obstacles. The objective is to maintain freedom of movement for maneuver units, weapon systems, and critical supplies. Mobility operations maintain freedom of tactical maneuver and operational movement through five functional areas: countermine, counterobstacle, gap crossing,

constructing combat roads and trails, and forward aviation combat engineering. Countermine activities detect, neutralize (through a combined arms breach or bypass), mark, and proof mined areas. Counterobstacle activities employ tactics and equipment to breach or bypass and ultimately reduce obstacles other than mines. Gap crossing fills gaps in the terrain to allow personnel and equipment to pass. Constructing combat roads and trails expediently prepares or repairs routes of travel for personnel and equipment. This includes temporary bypasses for damaged roads and bridges. Forward aviation combat engineering prepares or repairs expedient landing zones, forward arming and refueling points, landing strips, or other aviation support sites in the forward combat area (FM 3-34 2004, 3-3 to 3-5).

Countermobility is the augmentation of existing obstacles with reinforcing obstacles integrated with direct- and or indirect-fire systems to disrupt, fix, turn, or block the enemy. It physically shapes the area of operations to alter the scheme of maneuver of the enemy, giving the commander opportunities to exploit enemy vulnerabilities or react effectively to enemy actions. Countermobility provides the maneuver commander with increased time for target acquisition of enemy combat capabilities (FM 3-34 2004, 3-7).

The survivability function encompasses developing and constructing protective positions such as earthen berms, protective positions, and overhead protection as a means to mitigate the effectiveness of enemy weapons systems. It differs from survivability in the mobility, countermobility, and survivability battlefield operating system since the battlefield operating system includes deception, camouflage, operations security, and nuclear, biological, and chemical defense measures. Survivability is the ability of personnel, equipment, and facilities to continue to operate within a wide range of

conditions faced in a hostile environment. It is comprised of engineering-supported tasks such as general field fortifications; hardening of command, communication, and combat training locations; improvements to weapons systems firing positions and infantry fighting positions (FM 3-34 2004, 3-8).

Combat engineering units have a secondary mission to fight as infantry. Reorganizing and employing engineers as infantry requires serious consideration. Engineers provide far more combat power in their primary mission than when reconfigured as infantry. Stopping engineering work may reduce the combat power of the commander's entire force. Because of the long term impact, reorganizing engineers to fight as infantry is an operational issue, and careful consideration should be given to what level of command is authorized to order reorganization, normally corps commander or higher. Reorganization implies withdrawing engineer units to a rear area to issue infantry equipment such as antitank systems and providing them with other combined arms maneuver battalion assets, such as a fire support team and enhanced combat medical support. It also implies a period of training with these newly acquired assets (FM 3-34 2004, 1-4).

### Geospatial Engineering

Geospatial engineering consists of collecting, developing, disseminating, and analyzing positionally accurate terrain information that is tied to some earth reference. These actions provide mission-tailored data, tactical decision aids, and products that define the character of the zone for the maneuver commander. Key aspects of the topographic mission are geospatial databases, analysis, positional control, and printed maps. These aspects provide the commander a common view of the terrain, which leads

to a common operating picture that he uses for command and control. Engineer officers at the theater, corps, division, brigade, and battalion levels are responsible for geospatial engineering.

### General Engineering

General engineering encompasses those engineering tasks that establish and maintain the infrastructure required to conduct and sustain military operations. Such tasks include the general maintenance and repair of the lines of communication, main supply routes, airfields, utilities, and logistical facilities. General engineering tasks are typically performed to the rear of the division boundaries but can also be performed in forward areas. This function is usually performed by engineer units above division level and consists of repair and general tasks. The principles of general engineering in an area of operations are speed, economy, flexibility, decentralization of authority, and establishment of priorities (FM 3-34 2004, 3-10).

## Engineer Operations Organization

This section describes how engineer units doctrinally organize to provide combat and general engineering capabilities to the maneuver commander during offensive and stability operations. While the focus is on the division echelon, it will briefly address the theater and corps echelons of support. FM 3-34, *Engineer Operations*, chapter six, describes each level of engineering unit organization and begins with support to the theater operational level.

Theater Echelon Organization

Engineer mission responsibilities at the operational level include constructing, maintaining and rehabilitating the theater support base, and providing support to other services, agencies, and other multinational forces in the theater of operations. Relevant to the forward divisions, operational-level engineer units provide construction management for the Army forces headquarters or the Army service component command, contract construction support, and infrastructure enhancement and sustainment support organizations on an area or mission basis. The combatant commander may establish a theater regional contingency engineering management cell to prioritize engineering construction activities and augment the joint force staff. The engineer brigades and groups plan, coordinate, and supervise their assigned work in their respective areas of responsibility (FM 3-34 2004, 6-4 to 6-6).

Two types of engineer units provide the majority of general engineering capabilities. Combat heavy engineer battalions have a variety of equipment, tools, and skills to do all types of construction. Some capabilities, such as asphalt and paving, require pairing with separate engineering companies and teams to accomplish the mission. Construction support companies operate and maintain equipment to augment combat engineer battalions, heavy engineer battalions, and other units (FM 3-34 2004, 6-7). General engineering units and contract construction work together to build troop billeting and other facilities in theater. Maintenance of these structures falls into the category of real-property maintenance activities (RPMA).

The Army service component command has overall responsibility for RPMA. The theater support command, through its area support groups, normally provides the needed

RPMA support. Principal RPMA functions in a theater of operations include operating, repairing, and maintaining facilities and utilities; fire prevention and protection; and refuse collection and disposal. RPMA requirements that exceed the theater support command and area support group capabilities are forwarded to the supporting engineer group or brigade for execution according to the theater priorities. In operations where a robust theater support command and or area support group structure does not exist, but base camps, logistic bases, and other operating bases have been established, the facilities engineering detachments take on the larger task of conducting DPW bare-base facilities management services (FM 3-34 2004, 6-7 to 6-8).

Corps Tactical Echelon Organization

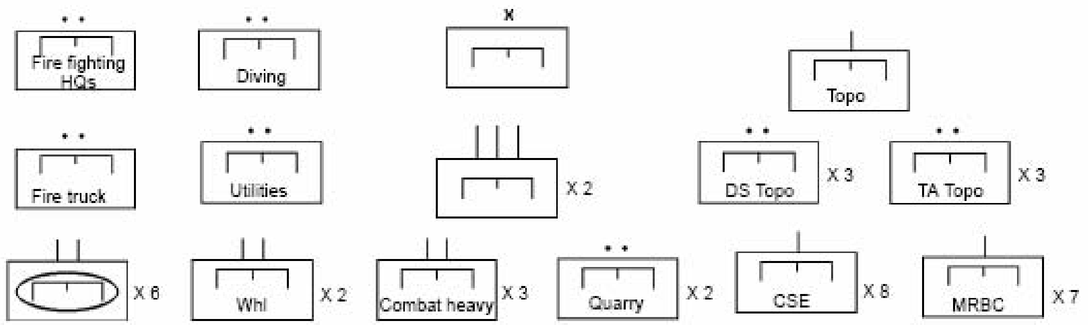
At the corps echelon, engineers perform battlespace functions (combat engineering, geospatial engineering, and general engineering) and have missions in all parts of the corps area. The general engineering mission in the corps area of operations is to construct and maintain lines of communication and tactical march routes. This mission is continuous due to the effects of enemy actions, heavy traffic, and weather. Corps engineer units operating in the forward area reinforce divisional engineers in combat engineering roles. Corps engineer units are typically combat support engineers. They usually perform mobility, countermobility, and survivability missions when operating in the division area as reinforcement to divisional engineers. Separate corps brigades and armored cavalry regiments have an organic engineer company, which is usually not sufficient to handle all required engineering tasks when these units are committed. These companies are designed and focused for supporting the mobility and countermobility portions of combat engineering. The corps engineer brigade reinforces these

organizations with additional combat battalions and separate companies based on the mission and the situation (FM 3-34 2004, 6-8 to 6-10).

Corps engineer units also perform the general engineering battlespace function. General engineering activities occur throughout the theater and are not limited to the communications zone. Within the corps area, operational construction requirements, such as forward logistics bases, heliports, and main supply routes are needed to ensure the continuity of support for combat operations. These activities are in addition to corps-generated construction requirements (bed down, logistics bases, and rehearsal ranges) that keep corps construction assets fully engaged. The nature of corps operations generally limits construction to the austere, essential facilities needed to sustain the current fight or support near-term major operations in offensive, defensive, and selected stability operations (FM 3-34 2004, 6-10).

Corps combat engineer battalions perform general engineering tasks in the division area. Combat support equipment companies augment the combat battalions with equipment to move earth and maintain or create horizontal surfaces such as roads and airstrips. Utility teams support the corps support command and provide RPMA and base operations support throughout the corps area. The engineer command provides additional support and technical guidance, as necessary. Frequently, in stability or support operations, United States Army Corps of Engineers (USACE) contractors or other contracting agents provide RPMA engineering services under the general oversight of Army engineers (FM 3-34 2004, 6-12). Figure 4 depicts a typical corps engineer brigade supporting three heavy divisions.

**Engineer Corps Brigade Supporting Three Heavy Divisions**




**Engineer brigade competencies—**

- Control corps engineer units not organic to divisions, separate maneuver brigades and ACR.
- Provide combat (M/CM/S), geospatial, and general engineering support to the corps.
- Augment engineer support to the divisions and other subordinate units.
- Require a major commitment of corps units to keep the LOCs and tactical march routes open to sustain the committed forces, shift other forces, and implement corps-directed attacks. Corps combat battalions perform those tasks with CSEs companies augmenting other units with horizontal equipment to maintain roads and airstrips.
- Provide wet and dry bridging multirole bridge company (MRBC) for use in LOC and other routes. A diving team performs scuba diving in forward combat areas (such as in river and far-shore reconnaissance), clears underwater obstacles, and supports assault float-bridging operations.
- Provide construction assets (combat heavy battalions and quarry teams) for operational construction requirements such as forward log bases, heliports, airfields, bed downs, and MSRs.
- Provide geospatial engineering for the corps; terrain teams provide geospatial (topographic) support for each assigned division.
- Provide fire fighting assets to support aviation units and petroleum units.
- Require utilities teams to support the corps support command (COSCOM) with RPMA support in the corps area.

Figure 4. Engineer Corps Brigade Supporting 3 Heavy Divisions

*Source*: U.S. Army, 2004c, FM 3-34, *Engineer Operations* (Fort Leonard Wood, MO: U.S. Army Training and Doctrine Command, U.S. Army Engineer School), 6-9.

## Division Echelon and Below

Divisions perform major tactical missions and can conduct sustained battles and engagements. The engineering forces organic to each division are tailored specifically to support that type of division. The corps engineer brigade provides additional engineer units based on the division's specific mission and tactical situation. The engineering

infrastructure at the higher echelons makes it possible to commit and sustain divisions in combat. Additional corps engineer battalions operate in the division on an area or mission task basis. Separate engineering companies, especially bridge companies, operate in support of the division as required. When a division has the priority and need for a large number of corps engineers, it will likely also have an engineer group in support to control the activities of these engineers (FM 3-34 2004, 6-10 to 6-11).

Combat engineering units rarely perform general engineering tasks within the division since their focus is on combat engineering tasks. Corps level or higher combat support engineer units typically perform general engineering tasks within the division. RPMA and base support operations needs are generally very limited at the division echelon and below, although certain contingency operations will heighten their importance. Support is provided by the corps engineer brigade and higher echelon Engineer Commands (ENCOMs) (FM 3-34 2004, 6-11 to 6-12).

Integrating the variety and special capabilities of engineering organizations requires an understanding of the various capabilities and limitations of the engineering assets available for any given mission. Besides Army engineers, there are a variety of other organizations that may be available to support the overall effort (FM 3-34 2004, 6-12). These organizations include USACE and other United States and allied military service engineers.

It is increasingly common to contract a wide range of engineering services with local or third party national organizations and civilian contractors (FM 3-34 2004, 6-12). These assets are typically used to free up military assets, minimizing the military footprint in a theater, when requirements exceed military capabilities or when the

engineering operations and requirements are to be conducted in areas that are relatively safe from active combat.

Preparing for stability operations is more difficult than preparing for combat operations because of the broad range of potential missions engineers are expected to participate in during stability operations. An early on-the-ground assessment by engineers is absolutely critical to tailor the engineering force properly and to support the follow-on engineering contingency operations force logistically. Results of this assessment are quickly passed to deployment planners to ensure that an adequate engineering support force arrives in the area of operations in a timely manner. The failure to provide these engineers may cause inadequate troop bed down, sanitation, and force protection to the deployed force. Table 1 lists the capabilities of the Army's major engineer units.

The available literature listed in chapter 2 has three important characteristics: (1) they provide a solid doctrinal foundation for offensive operations, stability operations, and engineering operations, (2) they demonstrate the fact that while there is a wealth of sources describing OIF prior to the end of major combat operations, there are few comprehensive works on OIF stability operations, and (3) they show that the FEF continues to develop and improve even as this thesis analyzes it. This thesis will illuminate OIF's engineering operations after major combat operations were declared over and provide a snapshot in time of how well the FEF addresses the challenges of operational transitions that surfaced during OIF. Chapter 3 will articulate the method for determining challenges inherent in transitioning engineering support between offensive and stability operations and enable evaluation of the FEF's ability to execute transitions.

Table 1. Engineering Unit Capabilities

| Unit | Combat Engineering Capabilities (*M/CM/S) | General Engineering Capabilities | Remarks |
|---|---|---|---|
| Divisional Engineering Battalion | Mobility (breaching, combat roads & trails)<br>Countermobility (obstacle emplacement)<br>Survivability (protective positions) | Limited | Organic to division |
| Corps Mechanized Battalion | Mobility<br>Countermobility<br>Survivability | Combat roads and trails | Normally attached to a heavy maneuver brigade or light maneuver division |
| Corps Wheel Battalion | Mobility<br>Countermobility<br>Survivability | Combat roads and trails | Normally attached to a heavy maneuver brigade or light maneuver division |
| Combat Heavy Battalion | Mobility (combat roads and trails)<br>Countermobility (obstacle emplacement)<br>Survivability (protective positions) | Vertical and horizontal construction | |
| Combat Support Company | Mobility (combat roads and trails)<br>Countermobility (obstacle emplacement)<br>Survivability (protective positions) | Horizontal construction | Augments a Combat Engineer Bn, Heavy Battalion, and other units |
| *M – mobility; C – countermobility; S – survivability | | | |

## CHAPTER 3

## RESEARCH METHODOLOGY

War is not an exact science

COL Chuck King,
Eighth U.S. Army Engineer

### A Qualitative Approach

The purpose of this chapter is to describe the methodology this thesis will use to answer the primary research question, Does the Future Engineer Force transition engineer units between offensive and stability operations in ways that achieve responsiveness, versatility, agility, effectiveness, and efficiency? This thesis will identify challenges faced by engineer units during OIF-1. It will then descriptively compare the solutions achieved by the OIF-F and the FEF. This will be a descriptive comparison. A qualitative research approach is used because the thesis evaluates how well the FEF executes operational transitions. Qualitative research studies investigate the quality of relationships, activities, situations, or materials (Fraenkel and Wallen 2003, 430).

### A Five-Step Research Methodology

The qualitative research method of this thesis has five steps

1. Define offensive operations, stability operations, and the Army of Excellence engineering capabilities that support these operations

2. Articulate the Engineer Regiment's primary challenge in supporting OIF

3. Describe the secondary and tertiary challenges engineer units faced in supporting OIF operations and how engineer units met those challenges. These engineer units are referred to as the OIF-F

4. Describe how the FEF would meet the challenges faced by the Engineer Regiment during OIF

5. Compare the solutions achieved by the OIF-F and the FEF.

Figure 5 depicts the five steps of the research methodology.

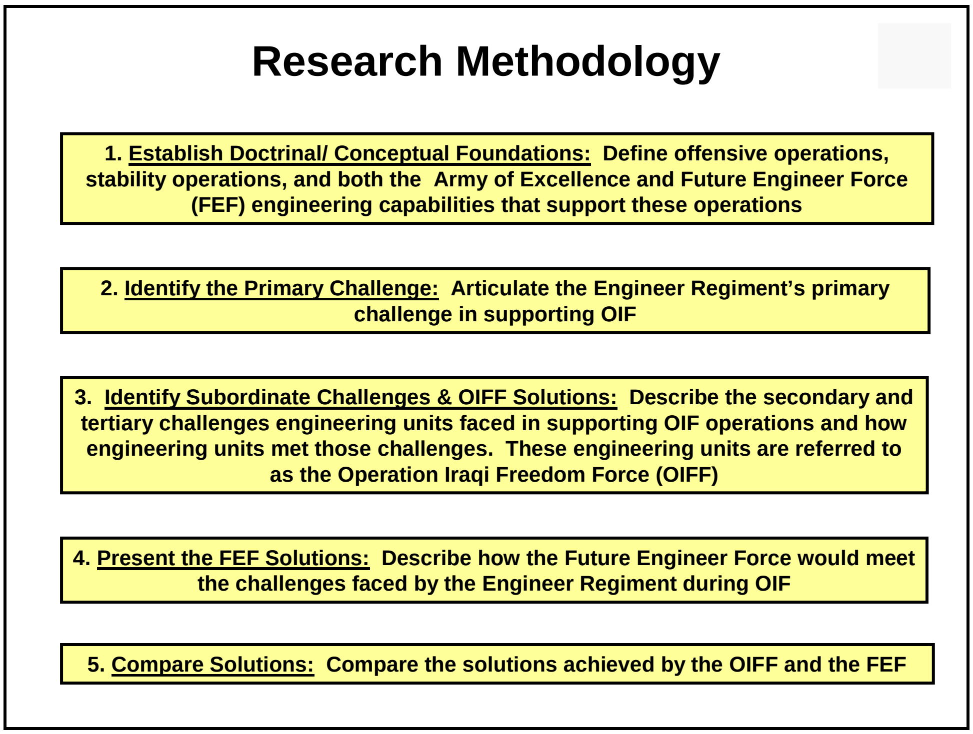



Figure 5. Research Methodology

Step 1: Establish Doctrinal and Conceptual Foundations

Step 1 laid the doctrinal foundations of the research question. Chapter 2, "Literature Review," completed this step. Army of Excellence doctrine contained in FM 3-0, *Operations*, and FM 3-90, *Tactics*, conveyed the nature of offensive and stability operations. FM 3-34, *Engineer Operations*, described the capabilities that the Engineer Regiment can provide to aid the Joint force commander to accomplish the mission.

## Step 2: Identify the Primary Challenge

The second step articulates the Engineer Regiment’s primary challenge in supporting OIF. For sake of simplicity, the challenge is stated here: How to transition engineer units from offensive operations to stability operations with limited augmentation in engineering capabilities. This limited augmentation in engineering capabilities translated into a requirement for the engineer units that began the OIF ground offensive phase to conduct the initial thirty to sixty days of the OIF stability phase with basically the same units.

## Step 3: Identify Subordinate Challenges and Operation Iraqi Freedom Force Solutions

The primary OIF challenge described above had several associated subordinate challenges. This thesis relied on primary references for this step of the research methodology. Live and telephone interviews with commanders and staff officers that served in OIF served as the basis for identifying the major problems. A survey conducted on field grade engineering officers attending the United States Army Command and General Staff School at Fort Leavenworth, Kansas, was used to determine how widespread some of these identified challenges were. Articles from the Army’s *Engineer Magazine*, and the Army’s initial summary of OIF offensive actions *On Point* by the Combat Studies Institute at Fort Leavenworth, Kansas, and other military publications also proved helpful. Chapter 4, “Analysis,” will group these identified challenges into six subordinate categories: (1) Capabilities, (2) Prioritization, (3) Command and control, (4) Strategic Mobility. (5) Operational Mobility, and (6) Training. These categories were drawn from the five secondary questions explained in chapter 1. The succeeding

paragraphs will define these six terms for the purposes of this thesis. These definitions are also included in the glossary.

The *American Heritage Dictionary* defines capability as, “the capacity to be used, treated, or developed for a specific purpose” (Houghton Mifflin Company 2002). The focus here is on the doctrinal engineering capabilities described in chapter 2, “Literature Review,” The focal question is, Does the assigned unit have the doctrinally appropriate capabilities to fulfill the requirements? Units that do not have the doctrinally appropriate capabilities to fulfill mission requirements have a capabilities challenge.

FM 1-02 defines priority of support as priorities set by the commander in his concept of operations and during execution to ensure combat support and combat service support are provided to subordinate elements in accordance with their relative importance to accomplishing the mission (2004, 1-150). Mission prioritization is an inherent challenge whenever requirements exceed capabilities. This inherent challenge is the focus of the prioritization category.

The United States Department of Defense definition of command and control is “the exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission” (FM 1-02 2004, 1-37). This thesis focuses on the arrangement of personnel, equipment, and communications that enable effective command and control. The focal question is: Does the unit headquarters responsible for the mission have the doctrinally

appropriate arrangement of personnel, equipment, and communications to accomplish the mission? Unit headquarters that do not have the doctrinally appropriate personnel, equipment, and communications for the assigned mission have a command and control challenge.

The United States Department of Defense defines strategic mobility as “the capability to deploy and sustain military forces worldwide in support of national strategy” (FM 1-02 2004, 1-177). This thesis includes the will of decision makers to employ strategic lift capabilities as an element of strategic mobility. Unit planners request capabilities to fulfill mission requirements. For the purposes of this thesis, units that did not receive the capabilities they requested for mission accomplishment had a strategic mobility challenge.

The North Atlantic Treaty Organization defines operational mobility as “the capability to move forces and their associated logistic support quickly and effectively within a region (intra-regional)” (1997). Units that experience significant challenges moving through the theater of operations have an operational mobility challenge.

Training is the means to achieve tactical and technical competence for specific tasks, conditions, and standards (FM 7-0 2002, iv). It is the process that melds human and materiel resources into these required capabilities. (FM 7-0 2002, 1-1). The focus of this category is on the “achieve tactical and technical competence” to meet mission requirements. The mission requirements of the COE demand that units be competent on a wide range of skill sets. Units that do not have the doctrinally appropriate tactical and technical competence for their assigned missions have a training challenge. See figure 6.

## Step 4: Present the Future Engineer Force Solutions

As stated in the introduction, the concepts for the FEF are not yet codified into new doctrine. Therefore, this thesis relied heavily on the FEF White Paper, the *FEF Operational and Organizational Plan*, and the *Army Guide to Modularity* as a basis for analysis. The FEF solutions that chapter 4, "Analysis," will present are the result of the researcher determining how the FEF would have supported OIF based on the three documents listed above. PowerPoint presentations, *Engineer* magazine, and United States Army Engineer School also provided insights into the analysis.

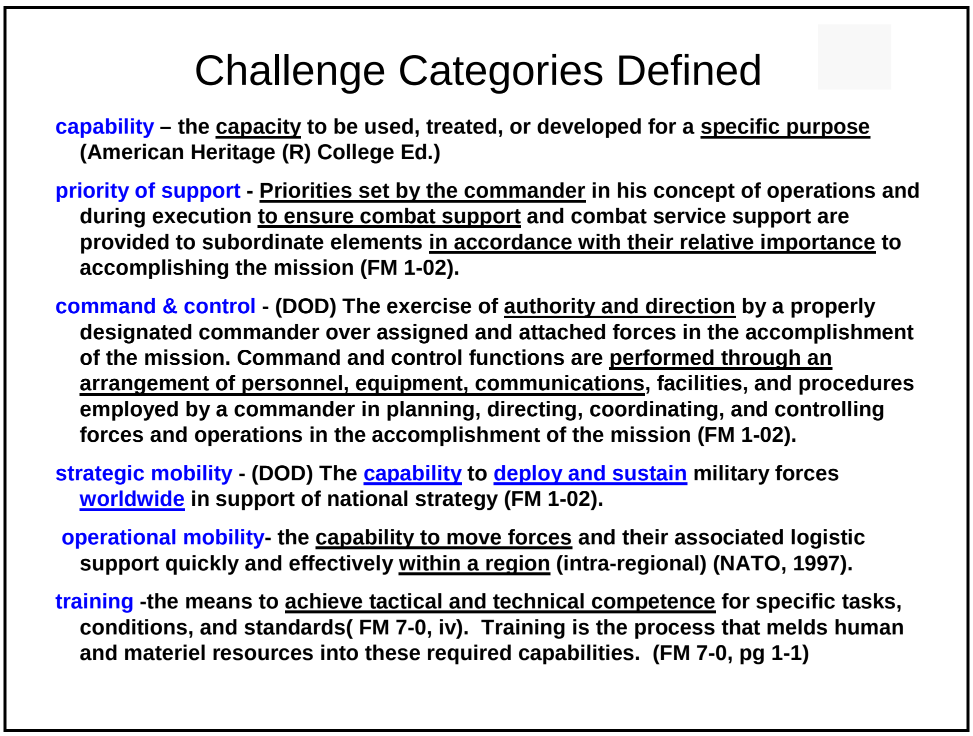



Figure 6. Challenge Categories

## Step 5: Compare Solutions

Step 5 will compare the quality of solutions presented by the OIF-F and the FEF. The primary research question has five qualifiers. Again, the research question is, Does the Future Engineer Force transition engineer units between offensive and stability operations in ways that achieve responsiveness, versatility, agility, effectiveness, and efficiency? Chapter 4 will use these five qualifiers to compare the OIF-F solutions to the FEF solutions. These qualifiers are: (1) Responsiveness, (2) Versatility, (3) Agility, (4) Effectiveness, and (5) Efficiency. The succeeding paragraphs will define the evaluation criteria for the purposes of this thesis. These definitions are also included in the glossary.

The Army defines responsiveness as, "an attribute of strategically responsive Army units; requires that the right Army forces--those the joint force commander needs to deter an adversary or take decisive action if deterrence fails--deploy to the right place at the right time; emphasizes training, planning, and preparation for deployment" (FM 3-0 2001, 3-2). This thesis focuses on whether the right forces deployed to the right place at the right time. A responsive solution employs the doctrinally appropriate units or executed the doctrinally appropriate unit modifications.

Versatility is:

> an attribute of strategically responsive Army units and a tenet of Army operations; the ability of an Army force package to reorganize and adapt to changing missions. Requires careful tailoring and sequencing forces into theater and making sure forces have the necessary C2, combat, CS, and CSS assets; encourages commanders to deploy multifunctional teams and to conduct home station training that emphasizes teamwork and adaptability. Commanders stress versatile C2 and practice reconfiguring headquarters to control multiple missions. (FM 3-0 2001, 3-3)

Versatility as an evaluation criteria focuses on the ability of a unit to reorganize and adapt to changing missions. It also emphasizes the ability of a unit to be multifunctional. A versatile solution demonstrates a unit's ability to reorganize, adapt to changing mission, and be multifunctional.

Agility is "an attribute of strategically responsive Army units and a tenet of Army operations; A responsive, agile force package is one that is sustainable and mobile enough to accomplish the mission. Agile forces are mentally and physically able to transition within or between types of operations without losing momentum. Mentally agile commanders, staffs, and soldiers adapt force packages, strategies, and tactics to mission requirements in dynamic environments" (FM 1-02 2004, 3-3). An agile solution demonstrates a unit's ability to transition without losing momentum.

The last two evaluation defined by the researcher are effectiveness and efficiency. Effectiveness is the ability of a force or operation to accomplish the mission by achieving the intended or expected effect. A solution that accomplishes the mission is effective. Efficiency is the ability of a force or operation to achieve effectiveness with a minimum of waste, expense or unnecessary effort. An efficient solution minimizes waste, expense, and unnecessary effort. See figure 7.

## Evaluation Criteria Defined

**responsiveness** - an attribute of strategically responsive Army units; requires that the right Army forces--those the JFC needs to deter an adversary or take decisive action if deterrence fails--deploy to the right place at the right time; emphasizes training, planning, and preparation for deployment (FM 3-0)

**versatility** - an attribute of strategically responsive Army units and a tenet of Army operations; the ability of an Army force package to reorganize and adapt to changing missions. Requires careful tailoring and sequencing forces into theater and making sure forces have the necessary C2, combat, CS, and CSS assets; encourages commanders to deploy multifunctional teams and to conduct home station training that emphasizes teamwork and adaptability. Commanders stress versatile C2 and practice reconfiguring headquarters to control multiple missions.

**agility** - an attribute of strategically responsive Army units and a tenet of Army operations; A responsive, agile force package is one that is sustainable and mobile enough to accomplish the mission. Agile forces are mentally and physically able to transition within or between types of operations without losing momentum. Mentally agile commanders, staffs, and soldiers adapt force packages, strategies, and tactics to mission requirements in dynamic environments. (FM 3-0)

**effectiveness**--the ability of a force or operation to accomplish the mission by achieving the intended or expected effect (researcher defined)

**efficiency**--the ability of a force or operation to achieve effectiveness with a minimum of waste, expense or unnecessary effort (researcher defined)

Figure 7. Evaluation Criteria

This comparison will be descriptive in nature. Chapter 4, “Analysis,” will sort the OIF challenges into the categories of step 3, Identify Subordinate Challenges and OIF-F Solutions. It will take one challenge and compare the solutions offered by the OIF-F and the FEF. The descriptive comparison will use the five evaluation criteria explained earlier in step 5, Compare Solutions. Once the solutions have been compared, the quality of overall solutions in each challenge category will be described. This will yield critical analysis of the FEF and suggestions for its improvement. See figure 8.

**Evaluation Matrix**

**Evaluation Criteria**

**Challenge Categories**

| | Responsive-ness | | Versatility | | Agility | | Effective-ness | | Efficiency | |
|---|---|---|---|---|---|---|---|---|---|---|
| | OIF | FEF | OIF | FEF | OIF | FEF | OIF | FEF | OIF | FEF |
| Capability | - | - | - | - | - | - | - | - | - | - |
| C2 | - | - | - | - | - | - | - | - | - | - |
| Priority of Support | - | - | - | - | - | - | - | - | - | - |
| Strategic Mobility | - | - | - | - | - | - | - | - | - | - |
| Operational Mobility | - | - | - | - | - | - | - | - | - | - |
| Training | - | - | - | - | - | - | - | - | - | - |

Figure 8. Evaluation Matrix

## Critical Analysis of the Future Engineer Force

The Engineer Regiment designed the FEF to better meet the challenges of the COE. This thesis uses OIF to represent an overall challenge of the COE. It considers the FEF as the solution. It evaluates the FEF solution by identifying challenges faced by engineer units supporting OIF and then comparing OIF-F solutions to FEF solutions. The logical assumption is that the FEF will do a better job of meeting OIF challenges. After completing the critical analysis of this research, challenges that are better met the OIF-F present will demonstrate areas where the FEF can be improved. These areas will become the recommendations chapter 5, "Conclusions and Recommendations." Figure 9 visually represents the critical analysis of the FEF.

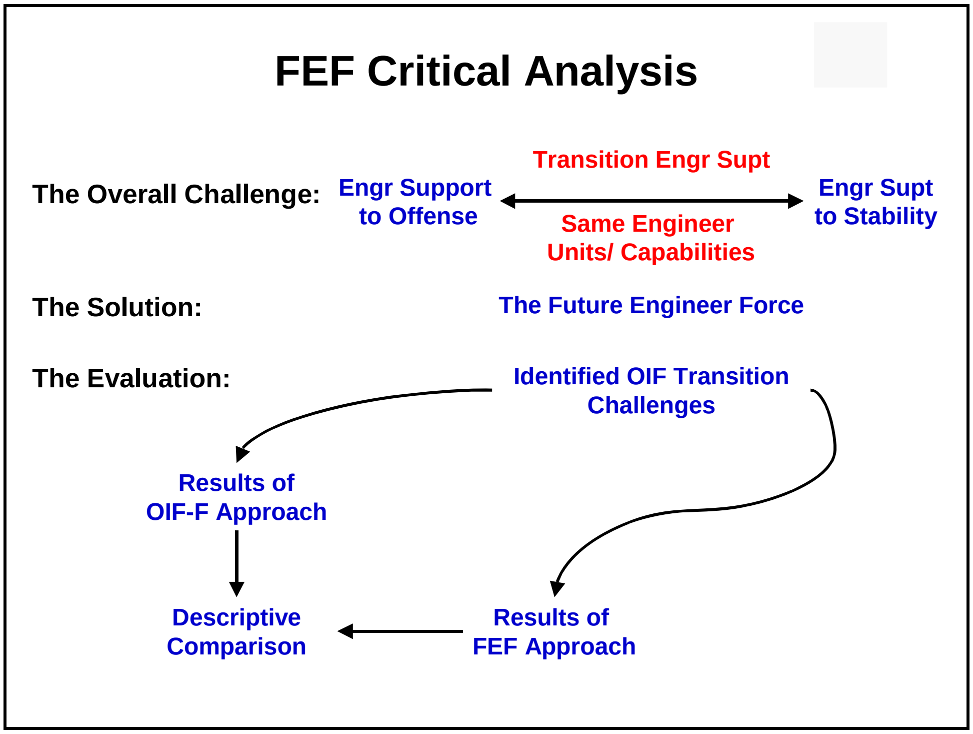


Figure 9. Future Engineer Force Critical Analysis

Chapter 3 described the research methodology this thesis will employ to answer the primary research question. Chapter 4 presents the analysis and results.

# CHAPTER 4

# ANALYSIS

> If you wear castles, you have to be an expert in the full spectrum of engineer operations from geospatial to general to combat engineering to infantry.
>
> LTC Ed Jackson
> Commander 54th Engineer Battalion

## The Engineer Regiment's Primary Challenge in Supporting Operation Iraqi Freedom

The Engineer Regiment supported OIF as an integrated member of the Army, Joint, Interagency, and Multinational team in Iraq. As shown in figure 10, the units that concluded the offensive fight were the identical units that initiated stability operations. There was little if any immediate augmentation in engineering capabilities to transition into the stability operations phase. Engineer units that were on the ground during the offensive phase would fulfill the first thirty to sixty days of stability phase engineering requirements. The challenge to the Engineer Regiment was how to support offensive operations, transition to stability operations, and support stability operations with basically the same engineer units and capabilities. The engineer units and capabilities that supported the overwhelming success against Iraqi conventional forces were now put to the test: Were they responsive enough to fulfill the requirements of this new phase of the operation? Were they versatile enough to reorganize, adapt to changing missions, and display multifunctional capabilities? Were they agile enough to transition within and between major operations without losing momentum? Were they effective enough to achieve the intended effects and efficient enough to minimize waste, loss, and unnecessary effort?

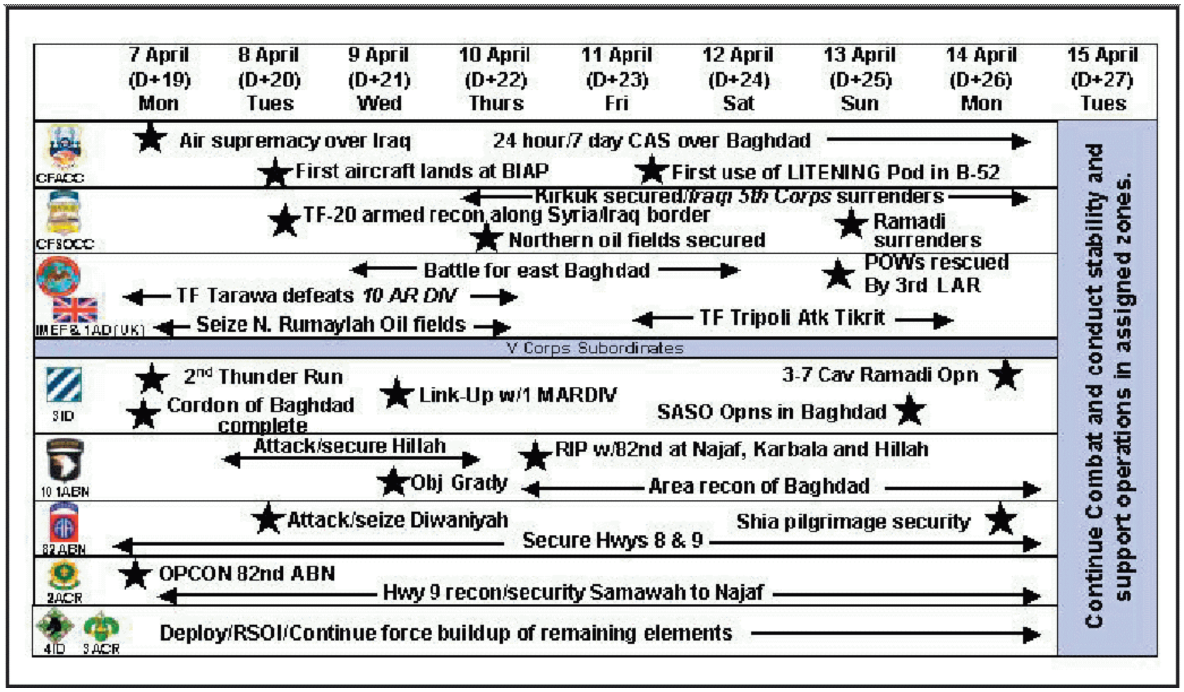



Figure 10. Regime collapse sequence of events

*Source:* Gregory Fontenot, E. J. Degen, and David Tohn, 2004, *On Point*, (Fort Leavenworth, KS: Combined Studies Institute Press), 330.

The need to maintain the support of local Iraqi civilians exacerbated the Engineer Regiment's primary challenge. Once stability operations commenced, critical civil infrastructures became key terrain. These infrastructures, "if controlled, would affect the local populace's attitudes toward coalition forces and their mission to provide for a safe and secure environment." In Mosul, this led the commanding general of the 101st Infantry Division (Air Assault) to embark upon an ambitions campaign to rebuild destroyed communications and food distribution networks and reestablish vital power to the communities (Reyes 2004, 8). The urgency to "keep the population on your side" was felt throughout the Iraqi theater of operations. For engineer units, this had two implications. First, this civil infrastructure had to be secured. With limited numbers of

infantry and military police units in theater, combat engineer battalions quickly received missions to conduct security operations across Iraq under the fight as infantry function. Second, this civil infrastructure had to be repaired. As a result of a decade of neglect by the Saddam Hussein regime and coalition combat operations, civil infrastructure was in a poor state of repair. Additionally, the Iraqi civilians that operated the civil infrastructure did not have the ability to immediately repair the infrastructure for a number of reasons (Peabody 2005a). The infrastructure repair mission fell upon the combat engineer commanders and USACE specialty teams serving in OIF.

This chapter will describe: (1) the secondary and tertiary challenges associated with the Engineer Regiment's primary challenge, (2) how engineer units overcame those challenges, and (3) how the FEF would meet those same challenges. This chapter proceeds with a snapshot of secondary and tertiary challenges. The engineer units and capabilities that supported OIF operations are referred to as the Operation Iraqi Freedom Force (OIF-F).

## Subordinate Challenges

### Capabilities

The central capabilities challenge was that there were insufficient engineering capabilities allocated for stability operations requirements. 64 percent of the polled CGSOC students concurred with this assessment. 26 percent were undecided. There were a number of causal factors for this capabilities challenge during OIF. One of the most significant factors was that mobilization planning was centralized at the National Command Authority. Engineer units simply did not have priority in the final mobilization plan. This translated into several subordinate challenges for the OIF-F. Combat

engineering units had to restore major civil infrastructure in Iraq with insufficient general engineering units (Peabody 2005a). They had to plan, design, and execute construction projects without general engineering units (Brinkley 2005). They had to conduct security operations under the fight as infantry function without doctrinal reorganization as infantry (Jackson 2005).

### Mission Prioritization

Given the lack of capabilities and the need to "keep the population on your side," prioritization became an important and fundamental challenge. This fundamental challenge had two subordinate challenges. First, planners had to determine what civil infrastructure to repair first. 67 percent of polled CGSOC students concurred with this statement. Second, they had to determine which area of operations would not receive the scarce general engineering units. 47 percent of polled CGSOC students concurred with this assessment while 41 percent were undecided.

### Command and Control

Engineering command and control structures that were optimized for offensive phase mobility were not doctrinally appropriate to meet the demands of OIF stability operations. This created a number of subordinate challenges. This thesis will focus on two of them. First, combat engineering unit headquarters had to plan and direct general engineering operations without doctrinally appropriate augmentation (Brinkley 2005). Second, those same headquarters had to, plan and direct security operations without doctrinally appropriate augmentation (Jackson 2005). Oftentimes, battalion headquarters had to simultaneously execute both general engineering and security operations.

Operational Mobility

The limited organic lift of general engineering battalions and the small size of specialty engineer units limited the operational mobility of selected engineering capabilities. This led to two subordinate challenges. First, engineer commanders had to move construction units around theater using limited organic lift assets. 56 percent of polled CGSOC students concurred with this assessment. Second, engineer commanders had to provide required specialty capabilities to maneuver commanders despite reality that associated units are too small to move independently (Toomey 2005). 59 percent of polled CGSOC students concurred that moving small units around theater was a significant challenge.

Training

Premobilization training focused on offensive mobility tasks and did not provide engineer units with the multifunctional tactical and technical competence to meet stability operations requirements. For the six months preceding the OIF ground war, combat engineering units focused on offensive mobility tasks such as minefield reduction, breaching, and river crossing operations (Peabody 2005a; and Jackson 2005). As OIF transitioned to the stability phase, there was a single central training challenge. Engineering commanders had to enable their combat engineer battalions and companies to perform a wide array of stability-related engineering and infantry tasks that were not emphasized during premobilization training. Figure 11 depicts consolidates the OIF-F challenges.

**OIF-F Challenges**

| | |
|---|---|
| **Capabilities** | **Overcome insufficiency of capabilities allocated to stability operations**<br>**- Mobilization planning was centralized at the National Command Authority**<br>**- Restore infrastructure without general engineering units**<br>**- Execute construction without general engineering units (i.e. basecamps)**<br>**- Conduct security operations (fight as infantry) without doctrinal augmentation or reorganization as infantry** |
| **Prioritization** | **Determine what infrastructure to repair first**<br>**Determine which area of operations will not receive general engineering units** |
| **C2** | **Plan and direct general engineering without augmentation in C2 structure**<br>**Plan and direct security operations (fight as infantry) without augmentation in C2 structure** |
| **Operational Mobility** | **Move construction units around theater using limited organic lift assets**<br>**Provide required specialty capabilities to maneuver commanders despite reality that associated units are too small to move independently** |
| **Training** | **Enable engineering battalions and companies to perform a wide array of stability-related engineering and infantry tasks that were not emphasized during premobilization training.** |

Figure 11. OIF-F Challenges

## The Operation Iraqi Freedom Solution

The purpose of this section is to describe how the OIF-F overcame selected engineering challenges during OIF. The OIF-F met the capabilities, command and control, operational mobility, and training challenges identified in this thesis by developing new capabilities while in theater, creating tailored force packages while in theater and demonstrating the ability to innovatively solve problems. Sewer, water, electrical, and trash (SWEAT) operations in Baghdad, tailored mission sets of the 94th Engineer Battalion, and mission execution of both the 1st and 54th Engineer Battalions illustrate these OIF-F solutions.

## Case Studies

Case Study 1: 3rd Infantry Division Engineer Brigade

The Engineering Mission: On 9 April 2003, the commander of 3rd Infantry Division (Mechanized) radioed the commander of his engineer brigade and instructed him to "turn on the lights on in Baghdad." The combination of collateral damage from combat operations and lack of infrastructure maintenance by Saddam Hussein's regime over the preceding decade left the Iraqi capital without electrical power (Colloton 2005). Additionally, the combined joint forces land component commander directed the division to execute hundreds of guard and reconnaissance missions within Baghdad, some of which were completed by the division's organic engineer battalions (Peabody 2005a).

Available Engineering Capabilities: The engineer brigade had its three organic mechanized combat engineer battalions that were in support of 3rd Infantry Division's maneuver brigades. Additionally, the V Corps engineering weighted the engineer brigade effort by attaching the 937th Engineer Group that contained: portions of the 94th Engineer Battalion (Combat) (Heavy), the 535th Engineer Company (Combat Support Equipment), the 54th Engineer Battalion (Corps Mechanized), and several multirole bridge companies (Martin and Johnson 2003, 3; and Fontenot et al. 2004, 456). The attached general engineering battalion, the 94th Engineer Battalion, had significant responsibilities at Baghdad International Airport, discussed later in this chapter (Grosskruger 2005). Additionally, the United States Army Corps of Engineers and the Combined Joint Forces Land Component Command formed Task Force Fajr with the specific mission to restore electrical power and related utilities in Baghdad and other key areas throughout Iraq. Their priority was to restore "24/7" power for hospitals, as well as

drinking water supply and sewage treatment systems (Colloton 2005). Task Force Fajr brought electrical, sewage, and water infrastructure expertise and a capability to make repairs of a limited scope.

Engineering Capabilities Shortfalls: Doctrinally, the engineer brigade had significant capabilities shortfalls for the assigned mission. The scope of Baghdad’s required general engineering work was beyond the brigade’s doctrinal mission set. The unit did not receive additional resources to address the shortfalls for at least thirty days. There was no doctrinal reorganization as infantry. For the previous six months, engineering unit training had focused on offensive tasks such as minefield reduction and river crossing. Soldiers did not train heavily on general engineering or fight as infantry tasks. Finally, Saddam Hussein intentionally minimized the number of people that had knowledge of Baghdad’s electrical infrastructure. Those that had knowledge of the power infrastructure only knew about their selected portions of the power infrastructure. No single person knew how it all fit together. This made assessing the damage much more difficult (Peabody 2005a). The engineer brigade would have to organize the local population’s engineers to successfully restore the power.

The Engineer Brigade Solution: The brigade headquarters reorganized its terrain team, assistant division engineering cell, and the majority of its brigade plans and operations cells into an ad hoc operations center to manage the infrastructure assessment of Baghdad. The ad hoc operations center collocated with Task Force Fajr and controlled the infrastructure reconnaissance missions of the engineer brigade’s subordinate engineer battalions. The ad hoc operations center and Task Force Fajr collaborated to eventually produce a simple infrastructure assessment methodology for use by combat engineering

units unfamiliar with the nuances of general engineering. By completing a general assessment checklist, combat engineering squads, platoons, and companies inspected each power generation and relay station, took photographs, and recorded information that was provided to the ad hoc brigade operations cell. Each day, the operations cell, Task Force Fajr, local Iraqi engineers, and local Iraqi leaders met to assess the significance of the engineering spot reports and prioritize efforts to restore Baghdad's infrastructure (see Appendix B) (Peabody 2005a). The combined efforts of the engineer brigade, Task Force Fajr, and local Iraqi leaders and engineers developed a new capability to assess and repair major civil infrastructure.

Analysis: Task Force Fajr represented the Engineer Regiment's ability to quickly tailor a force package to meet emergent requirements. The engineer brigade staff reorganization also demonstrates the flexibility engineer units' possess to tailor their organization to meet emergent requirements. Innovative leaders and Soldiers collaborated to develop organizing and tracking solutions that gave the force the capabilities needed to meet mission requirements. One can consider the originally organized units to be a combination of skills, manpower, and equipment. By removing mental barriers, the units created a new combination of skills, manpower, and equipment in a matter of days or weeks. Such reorganization would have taken more than a year to accomplish in peacetime.

Case Study 2: 94th Engineer Battalion (Combat) (Heavy),
Attached to 3rd Infantry Division (Mechanized)

The Engineering Mission: On 3 April 2003, 3rd Infantry Division engineer brigade commander informed the 94th Engineer Battalion commander of the impending

seizure of Baghdad International Airport. He requested a general engineering force package to open the airport, clear it of obstacles, and provide general airfield repair. The 94th Engineer Battalion commander was 60-70 kilometers south of Baghdad upon receipt of the mission (Grosskruger 2005).

Available Engineering Capabilities: At the onset of offensive operations, the 94th Engineer Battalion divided its subordinate companies into 11 types of ad hoc mission sets. These mission sets were tailored to the offensive mobility tasks for 3rd Infantry Division’s attack to Baghdad. Some of the mission set types included route upgrade, main supply route repair, breaching of berms, airfield clearance, bridge approaches construction, force protection berms, airfield construction, unmanned aerial vehicle (UAV) airfield construction, and airfield crater repair. A bank prep capability package with command and control and D7 bulldozers was attached to the 54th Engineer Battalion in support of mobility and bridging operations on the Euphrates River (Grosskruger 2005).

Engineering Capabilities Shortfalls: The 94th Engineer Battalion was one of two general engineering battalions in the Iraq theater (Jackson 2005). The battalion operated over a space of 20,000 square kilometers, an area just smaller than the state of New Jersey. Command and control of the battalion over such a wide area was a significant challenge. Additionally, the battalion did not have the digital communication equipment, such as FBCB2, MCS, and others, to enhance command and control and tracking with the supported maneuver units. The majority of the unit’s vehicles did not have a radio to aid in command and control. Also, the battalion did not have sufficient organic lift assets to

move its bulldozers and heavy equipment in one trip. This condition limited its operational mobility (Grosskruger 2005).

The 94th Engineer Battalion Solution: The use of mission sets greatly enhanced the battalion's ability to support maneuver operations over its large are of operations. In a 2005 interview, the unit's commander said, "It's hard to see any other ay we could have done the mission other than use a construct analogous to Future Force modules." During OIF and during its preceding deployments, the battalion never took a pure company or pure platoon to accomplish any task. The soldiers were adept at forming these ad hoc organizations. As OIF continued, the 94th Engineer Battalion's modules grew to include cordon and search support, clearing fields of fire, counter mortar, counter rocket, high-end infrastructure repair, and humanitarian support (Grosskruger 2005).

The bridge approach mission set assigned to open the airport determined the serviceability of the airport power plant by collaborating with stateside USACE engineers by video teleconference. They also made assessments of airport infrastructure and the water pumping station. Over time, the battalion expanded its role at the airport to force protection infrastructure assessment and repair for humanitarian and logistics purposes. They completed approximately 30 to 40 major missions in the first three weeks spent in Baghdad, and approximately 600 missions during the initial thirty to sixty days of the stability phase (Grosskruger 2005).

Analysis: The 94th Engineer Battalion's mission execution demonstrates the value of planned force packages to overall mission success. Reorganizaing the battalion into smaller units tailored for anticipated missions had several impacts. It greatly simplified the battalion's transition to stability operations, provided tailored command

and control to each supported unit, and gave the battalion greater flexibility in responding to emergent missions. It must be noted that offensive and stability operations tasks for general engineering units differ much less than those of combat engineering units. Still, embracing a totally tailorable force structure paid significant dividends for the 94th Engineer Battalion.

Case Study 3: 1st Engineer Battalion (Combat) (Mechanized),
of 1st Infantry Division (Mechanized)

The Engineering Mission: The 1st Engineer Battalion arrived in Iraq after the transition to stability operations. However, its training focus and task organization was optimized for offensive operations just as the engineer battalions of 3rd Infantry Division were. The 1st Engineer Battalion had three distinct battalion-sized jobs: (1) fight as an infantry task force conducting search and attack operations to destroy enemy weapon caches, (2) build and maintain a 6,000 Soldier base camp with four satellite camps, and (3) be the DPW and facilities contracting agent for the base camp network.

Available Engineering Capabilities: The 1st Engineer Battalion had its organic combat engineering companies along with the 248th Construction Company (Combat) (Heavy) out of the Norwich, Connecticut National Guard. It also had an attached nuclear, biological, and chemical platoon. The unit was fortunate enough to have a visit from a USACE FEST team, however the FEST team suggestions could not be implemented with the unit’s limited general engineering equipment and skill sets. Also, the reachback capabilities of the USACE tele-engineering systems were available only at the division level (Brinkley 2005).

Engineering Capabilities Shortfalls: Despite its fight as infantry mission, 1st Engineer Battalion did not receive the doctrinally recommended enhancements to fight as infantry. It did not have a robust enough staff structure to perform the varied missions. For example, the staff lacked a fire support officer, air operations officer (S3-Air), and branch specific intelligence officer for the fight as infantry mission. The battalion's logistics staff was small compared to the infantry battalion logistics staff, and the communications package was modest. It did not receive the digital systems to enhance operations as a maneuver element, such as FBCB2, ASAS, and others. For the construction mission it did not have a construction engineering planning section to design the base camp. Finally, its training focus for the previous six months was on offensive mobility tasks. That training did include fight as infantry tasks (Brinkley 2005).

The 1st Engineer Battalion Solution: Like the 3rd Infantry Division's engineer brigade, 1st Engineer Battalion significantly modified its composition. The battalion took its three organic assault and obstacle platoons and its one organic support platoon and reorganized them into four wheeled combat engineering platoons in armored high mobility multipurpose wheeled vehicle. Their attached nuclear, biological, and chemical decontamination platoon reorganized into a reconnaissance and quick reaction force platoon. The headquarters company converted into a wheeled combat engineer company and routinely received attached mechanized infantry, mechanized engineering, and United States Marine Corps platoons to conduct combat operations (Brinkley 2005).

To accomplish the general engineering mission, commander of the attached 248th engineer company and then the commander of the battalion's headquarters company served as the construction headquarters chief. The assistant brigade engineering and the

battalion operations officer functioned as the battalion’s professional engineers. The headquarters company commander was responsible for the “mayor’s” cell functions. The mayor’s cell was responsible for public works, sanitation, facilities and road maintenance, power generation, and water treatment and distribution. The battalion executive officer prioritized mayor’s cell missions, but the captain planned and executed them. This reorganization enabled the commander and battalion operations officer to command and control the three to four “gun-fighting” engineering companies on any given fight as infantry mission. (Brinkley 2005).

Analysis: The 1st Engineer Battalion’s major in-country reorganization gave the battalion it’s mission-required capabilities. They created a DPW, a construction planning section, four maneuver platoons, and a quick reaction force all out of their existing task organization. Innovative problem-solving enabled the battalion to simultaneously command and control and execute fight as infantry missions and base camp operations. The 1st Engineer Battalions activities demonstrate that engineer units can effectively carry out fight as infantry security missions despite a lack of home station training focus. They also demonstrate the ability of engineer units to take their doctrinal combination of skills, manpower, and equipment and gain new capabilities by creating a new combination of skills, manpower, and equipment in a short period of time.

## Case Study 4: 54th Engineer Battalion OPCON to 3rd Armored Cavalry Regiment

The Engineering Mission: The 54th Engineer Battalion supported V Corps, 3rd Infantry Division (Mechanized), and the 3rd Armored Cavalry Regiment. While it supported the 3rd Armored Cavalry Regiment, it operated in Western Iraq’s Al Anbar

Province. See figure 12. Its major tasks were to: (1) repair road and airfield infrastructure, (2) build and maintain force protection and Soldier quality of life structures for the regiment, and (3) fight as infantry by conducting patrols and guard missions alongside the maneuver units of 3rd Armored Cavalry Regiment. The roads and airfields were damaged by the combined joint forces air component command during the offensive fight, and now needed repair in order to accommodate humanitarian supplies arriving from Jordan.

Available Engineering Assets: The 54th Engineer Battalion controlled two of its three its organic combat engineer companies, the 761st Ordinance Company (Explosive Ordinance Disposal), a terrain team from the 320th Engineer Company, and eventually received Alpha Company, 142d Engineer Battalion (Combat Heavy) from the North Dakota National Guard.


Figure 12. Al Anbar Province

*Source:* University of Texas, 2004, Iraq political map, *Perry-Castañeda library map collection*; available from http://www.lib.utexas.edu/maps/middle_east_and_asia/iraq_pol_2004.jpg; internet; accessed on 17 April 2005.

Engineering Capabilities Shortfalls: Despite the road repair and upgrade mission scope, the 54th Engineer Battalion did not receive its general engineering unit, Alpha

Company of the 142nd Engineer Battalion, until thirty days after its support to 3rd Armored Cavalry Regiment began. The priority for the two general engineering units in the Iraq theater was to Baghdad and life support area Anaconda near Ballad. The 54th did not have adequate construction equipment needed to conduct its general engineering mission. Unit premobilization training focused on offensive mobility tasks such as minefield reduction and river crossing, so it did not conduct significant training on fight as infantry tasks. The 3rd Armored Cavalry Regiment area of responsibility spanned 139,000 square kilometers from the borders of Syria, Jordan, and Saudi Arabia to the outskirts of Baghdad (Jackson 2004). This area was approximately the size of New York State. This created a significant command and control challenge. Finally, the battalion did not have a civil military operations section or certified contracting officer to help locate and employ skilled Iraqi citizens to support the general engineering mission (Jackson 2005).

The 54th Engineer Battalion Solution: The battalion tactical operations center collocated with the regiment's tactical operations center in Ar Ramadi while the remainder of the headquarters company moved two hours west to Al Asad Air Base (see figure 13) to support the Support Squadron and fourth squadron of 3rd Armored Cavalry Regiment. The explosive ordinance company headquarters remained with the 54th Engineer Battalion headquarters. To support 3rd Armored Cavalry Regiment operations throughout the area of responsibility, the 54th Engineer Battalion commander assigned his two engineering companies to two of the ground cavalry squadrons to perform combat engineering, infantry missions, and construction-related projects. The third ground cavalry squadron received the regiment's organic combat engineer company.

Each combat company was augmented with an EOD team to destroy caches and clear unexploded ordinance. At the battalion staff level, the operations officer established an internal construction management section for the general engineering missions (Jackson 2004).

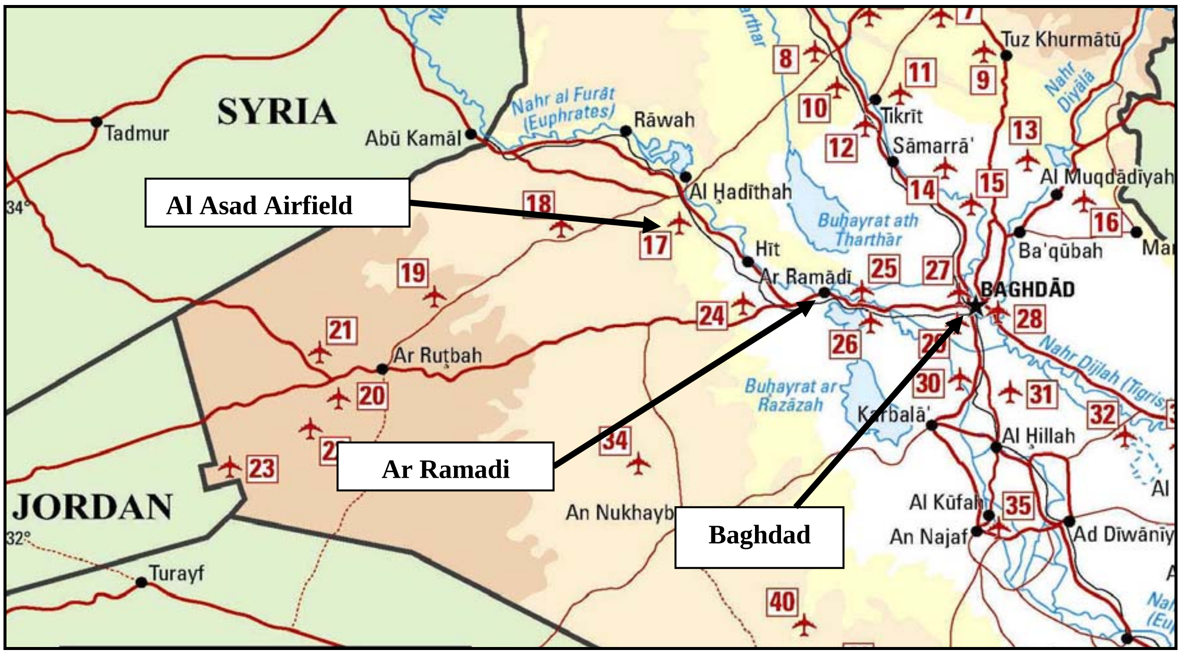



Figure 13. Al Asad Airfield and Ar Ramadi

*Source:* Global Security, 2002, Iraq Airfield Map, June; available from http://www. globalsecurity.org/military/world/iraq/iraq-map_airfields_gsmb_hr.htm; internet; accessed on 17 April 2005. Reproduced with permission of Global Security.org.

While awaiting the combat heavy company, the battalion's leadership employed organic earthmoving equipment (small equipment excavators--small equipment excavators, and armored combat earthmovers--armored combat earthmovers) to begin the road and airfield repair missions. The 54th Engineer Battalion leadership relied on the personal experience and expertise of their combat engineer Soldiers to execute selected

vertical construction tasks such as establishing minor power grids, rewiring lights and sockets, repairing air conditioners, and constructing force protection and field sanitation facilities (Jackson 2004). They also queried local Iraqi sheiks to find building materials and skilled labor that could perform construction for unit missions. The shortfall in qualified contracting and obligating officers inhibited unit efforts to acquire sufficient building materials and skilled labor. This initially led to inflated prices for materials until competition among locals stabilized the market (Jackson 2005).

The combat engineering companies supporting the 3rd Armored Cavalry Regiment's squadrons performed the general engineering mission by building field latrines, hand-washing stations, and showers. They also set up minor power grids, rewired lights and sockets, repaired air conditioners, and even installed ceiling fans. They teamed with civil affairs teams and USACE FEST elements to assess infrastructure in local towns in much the same fashion that 3rd Infantry Division's engineer brigade had done in Baghdad. In addition, they identified numerous goodwill projects such as the construction of soccer fields, playgrounds, and central parks. The headquarters company commander sought out and hired the former Al Asad base engineers which consisted of, an Iraqi citizen and a team of local nationals. These engineers got the infrastructure up and running in short order since Al Asad had only recently been abandoned and had not been subjected to the level of looting experienced elsewhere in theater. The line companies also operated traffic control points, conducted presence patrols and search operations, and helped civil affairs teams with civil servant wage distribution.

The battalion's ad hoc construction management section established contracts for improved life support for the regimental tactical operating center and the Soldiers of 1-5

Field Artillery Battalion, living near the university in Ar Ramadi. Improvements included emplacing gravel, paving, installing an improved power grid, and air conditioning tents and dining facilities.

Analysis: Despite their predeployment focus on combat engineering tasks, the company and battalion commanders of the 54th Engineer Battalion served as total force engineers for their supported maneuver commanders. Undoubtedly, their experience supporting the 3rd Infantry Division in Baghdad the previous month helped gain general engineering proficiency quickly in order to support 3rd Armored Cavalry Regiment. Although combat engineering noncommissioned officer courses no longer teach general engineering tasks, there was sufficient general engineering familiarity in the unit to enable successful mission accomplishment. The combat engineering focused SEE and ACE proved moderately effective at initiating the road and airfield repair missions. The 54th Engineer Battalion's adaptation to the 3rd Armored Cavalry Regiment mission demonstrates the Engineer Regiment's ability to quickly expand leader expertise and leverage Soldier experience.

## Prioritization

The purpose of this subsection is to describe how the OIF-F dealt with mission prioritization challenges during OIF. The OIF-F met these challenges by: (1) gaining the trust of the maneuver commander, (2) thoroughly understanding the commander's intent, (3) advising the commander of anticipated engineering unit capabilities, shortfalls, and needs, (4) recommending engineering unit employment options to the maneuver commander, and (5) remaining focused on the commander's intent during mission

execution. The 54th Engineer Battalion and the130th Engineer Brigade each illustrate this solution.

Case Study 5: 54th Engineer Battalion (Combat) (Mechanized)
OPCON to 3rd Armored Cavalry Regiment

The Engineering Missions: The 54th Engineer Battalion had to complete road and airfield repair missions, base camp construction and maintenance mission, and fight as infantry missions (Jackson 2005).

Priorities in Conflict: The force protection structures had to be constructed in advance of and upon arrival of 3rd Armored Cavalry Regiment. The relief supplies were needed to ease the suffering of local Iraqi citizens. The fight as infantry security patrols were required to maintain overall stability in the province.

The 54th Engineer Battalion Solution: The 54th Engineer Battalion commander prioritized the missions, presented them as a recommendation to the 3rd Armored Cavalry Regiment commander, and adjusted according to the maneuver commander’s guidance. The immediate need was provision of force protection measures and assured mobility to get the regiment into its forward operating base. The engineer commander gave the regimental commander an assessment of the things he thought should be done, things he thought he could do, and things he could not do, such as detailed infrastructure assessments due to lack of available FEST assets. In weekly one-on-one meetings with the regimental commander, the engineer commander developed an engineering support plan. The engineer battalion planning team further synchronized the engineering support plan with the regiment’s other battlefield operating systems. Battalion planners

accomplished this by remaining closely integrated with the 3rd Armored Cavalry Regiment engineer, the regiment's organic engineering planning cell (Jackson 2005).

Analysis: The 54th Engineer Battalion had varied mission requirements, significant capabilities shortages, and a huge area of operations. Mission requirements were pressing. There was great potential for the priorities of the 3rd Armored Cavalry Regiment, V Corps, local Iraqi leaders, and the 130th Engineer Brigade to emphasize different parts of these mission requirements. The engineer commander did not wait for the maneuver commander to assign tasks. Instead, he proactively gave a capabilities, requirements, and shortfalls analysis; presented options, and enabled the maneuver commander to adjust that analysis instead of forcing the maneuver commander to start from scratch.

Observations: Engineer commanders prioritize missions at the brigade level and enable the maneuver commander to adjust an 80 percent solution. Engineer commanders can effectively integrate into a brigade-level maneuver unit in a short period of time--a few days in this case. Engineer commanders must educate their maneuver commanders on capabilities, requirements, shortfalls, and employment options. Engineers must ensure their operations are synchronized to produce the commander's desired effect.

Case Study 6: 130th Engineer Brigade in Support of V Corps

The Engineering Role: The 130th Engineer Brigade was the highest echelon of V Corps' engineer command and control and provided planners for all of the corps' OIF campaign planning (Wallace 2005).

The 130th Engineer Brigade Solution: V Corps and the 130th Engineer Brigade collaborated to determine the priority and sequence of engineering mission requirements. After identifying these requirements, they embedded the appropriate engineering capability to meet those requirements. For example, obstacle reduction capability was embedded in the subordinate command by attaching the 54th Engineer Battalion (Combat) (Mechanized) to 3rd Infantry Division. Assault gap crossings were anticipated west of An Nassariyah and across the Euphrates River. The requisite bridging engineer units were embedded with the units that would first encounter potential crossing sites. The corps selected its logistics support area, logistics support area Bushmaster, because it was next to an unimproved dirt airstrip. General engineering units that could upgrade the airstrip for UAV and C130 landings were front-loaded in the corps formation to ensure the airstrips would be available as early as possible (Wallace 2005).

Once combat operations actually began, V Corps gave the 130th Engineer Brigade wide latitude to command and control and re-task organize the theater’s engineer units. Subordinate engineer units in the corps, 3rd Infantry Division, and other subordinate maneuver units were able to directly contact the 130th Engineer Brigade, state the nature of their engineering challenges, and request the appropriate assets. If those assets were available, the 130th Engineer Brigade had authority to send them to the requesting engineering headquarters. The division and corps staffs would still be informed of the action and direct contact with the 130th Engineer Brigade was encouraged in order to improve response time and flexibility (Wallace 2005).

Once the coalition defeated the Iraqi Army and Saddam Hussein’s regime fell, emergent mission requirements became more numerous than planned. The level of

engineering work required to restore Baghdad and other major cities was unanticipated and massive due to the lack of infrastructure maintenance by Saddam Hussein's regime. Stability operations in Iraq soon intensified, and the 130th Engineer Brigade sought opportunities to employ their assigned assets. For example, a bridge in Tikrit that was bombed by coalition aircraft during offensive operations could only accommodate one-way traffic. This created a significant inconvenience and economic obstacle for the people of Tikrit. Engineer units constructed the largest float bridge ever erected by an engineering unit to enable traffic to move from west to east. The bridge was eighty-five bays long and took two and a half bridge companies to assemble. In Mosul, a Kurdish party leader requested repair of bridge apparently bombed by coalition aircraft during offensive operations. Engineer units installed a Bailey bridge that reestablished traffic (Wallace 2005).

Analysis: The 130th Engineer Brigade integrated its engineering experience and expertise into V Corps planning during the initial stages of campaign planning. This enabled early assessment of offensive phase mission requirements and places where engineering combat power was uniquely suited to help achieve the commander's intent. Early planning integration ensured that subordinate commanders had the appropriate engineer units embedded in their formations to accomplish their anticipated tasks. Prioritizing missions during campaign planning is a matter of looking at requirements and the sequence of operations, and then embedding that capability in the force. By delegating task organizing authority to the 130th Engineer Brigade, V Corps helped the OIF-F to be flexible in adapting to emerging mission requirements.

Observations: Resourcing engineering planning staff paid great dividends during execution as witnessed during the offensive fight. Engineer integration into corps planning helps ensure maximum engineering synchronization to produce the commander's desired effects. It is critical that engineers are well-integrated in the early stages of campaign planning. Designing engineering support to a maneuver plan that is already completed is not the optimal way to do business. Simultaneous, integrated planning optimizes the use of resources to achieve the commander's intent. When engineering unit leaders and planners clearly understand the commander's intent, they can more develop task organization more independently and effectively. It also enables them to quickly capitalize on opportunities to use engineering combat power to meet the commander's intent.

## Operation Iraqi Freedom Force Evaluation

The purpose of this subsection is to evaluate the responsiveness, versatility, agility, effectiveness, and efficiency of the above solutions. Overall, OIF-F solutions were versatile and effective, but lacked responsiveness, agility, and efficiency.

### Grouped by Evaluation Criteria

#### Responsiveness

Capabilities: The combat engineering units employed for OIF stability operations were doctrinally inappropriate for the general engineering and fight as infantry missions. Doctrinally, the right unit was not employed at the right place at the right time. While innovative solutions provided strong solutions to the Baghdad infrastructure problem, the fact remains that the doctrinally right unit was not employed at the right place at the right

time. It must be noted that the United States Office of Reconstruction and Humanitarian Assistance took oversight of this mission later in 2003 as planned. The combat engineering units were likewise inappropriate for the security missions. Doctrine describes how to resource an engineer battalion to conduct a fight as infantry mission. Without such reorganization, the OIF-F was not doctrinally responsive.

The general engineering units were well suited to the Baghdad International Airport mission. Their relative ease in transitioning from river crossing operations along the Euphrates River to airfield opening operations demonstrates an important feature of general engineering units. Their engineering role does not seem to change significantly between offensive and stability operations. While there are significant differences between these operations for maneuver units, the tasks of moving dirt, creating even grades, and improving structures are applicable to both operations.

Prioritization and Command and Control: The battalion, brigade, and corps headquarters were quite appropriate for prioritizing engineering requirements. The strong relationships formed between the maneuver commander and his supporting engineer commander were evident in the amount of responsibility given to the brigade and corps commanders and the receptiveness those commanders had to engineer commander recommendations. It is notable that the 54th Engineer Commander seemed to gain a high level of trust from the 3rd Armored Cavalry Regiment commander despite the lack of organic relationship and the relatively short time to integrate the two units. The experience gained by the 54th Engineer Battalion during the offensive phase with V Corps and 3rd Infantry Division undoubtedly bolstered the credibility of the engineer commander.

The combat engineering headquarters was not appropriately resourced to conduct the general engineering or fight as infantry missions. The innovative solutions that enabled the ad hoc capabilities for these missions also enabled the battalion headquarters to complete these missions. However, they were inappropriately resourced for the task.

Operational Mobility: Despite a significant shortfall in organic lift capability, the general engineering units arrived at the desired site at an appropriate time. Educating the gaining commander of operational mobility needs and good operational lift management enabled the general engineering units to overcome the shortfall.

Training: The offensive training focus that enabled overwhelming success in the offensive phase left the combat engineering units ill prepared for the general engineering and fight as infantry missions.

Versatility

Capabilities: Despite lacking the doctrinal capabilities upon mission receipt, combat engineers units demonstrated that the ability to adapt to changing circumstances and reorganize to meet new requirements. The use of SWEAT operations and development of infantry capabilities at the battalion level illustrate the ability to adapt and reorganize. Doctrinally, combat engineering units have limited functionality when stability operations demand significant general engineering. However, the demonstrated willingness to gain new capabilities and relative success of those capabilities during OIF stability operations illustrates the versatility of combat engineering units.

General engineering units have a wide functionality when stability operations demand significant general engineering. The fact that the 94th Engineer Battalion was

already accustomed to tailoring and reorganizing greatly enhanced this inherent multifunctional capability.

Prioritization and Command and Control: The ability of combat engineer battalions to adapt new capabilities gave engineering headquarters great flexibility in mission prioritization. Despite a lack of doctrinally appropriate units or capabilities, engineer commanders had options available to accomplish the mission. The experience gained by the 54th Engineer Battalion during OIF offensive operations and the beginning of stabilization operation in Baghdad appears to have been significant in enabling the engineer company commanders to support their squadron commander without a robust presence from the engineer battalion commander.

The OIF-F adapted well to anticipated transitions by embedding engineers at the right places in the formation to address foreseen challenges. The OIF-F also displayed great adaptability in fulfilling the corps directed security operations that employed resources that were also needed for guarding Baghdad power stations and restoring electricity to the city.

Operational Mobility: The mission sets of the 94th Engineer Battalion enabled the unit to adapt to changing missions in various locations of the Iraqi theater.

Training: Home station training did not doctrinally prepare the OIF-F for the array of tasks OIF demanded. On the job training once stability operations began brought about capabilities in SWEAT operations and fight as infantry tasks. In light of the varied missions of OIF offensive and stability operations, it is a significant challenge to determine the appropriate focus tasks for home station training.

Agility

Capabilities: While the OIF-F quickly developed new capabilities to meet stability phase requirements, the transition of those capabilities lacked agility. Upon transitioning to stability operations, engineer units produced good situation assessments and generated sound plans. Although not directly mentioned by the interview respondents, this thesis assumes there was great difficulty transitioning between offensive and stability operations during OIF for a number of reasons. The status of regime collapse was uncertain, looting and crime in the cities grew quickly, and the scope of the general engineering and fight as infantry missions was wide. In the midst of these uncertainties, units and headquarters underwent significant reorganization to execute missions they were not trained for. It takes time to transition a combat engineer battalion to assume DPW responsibilities, adopt a wheeled engineer company configuration, and prepare for fight as infantry missions. These are not conditions that are quickly overcome.

Prioritization: Mission prioritization appears to have been a strong suit of the OIF-F transition to stability operations. The relationship of trust between the engineering and maneuver commanders was a significant factor in this strength. Engineer commanders displayed a keen understanding of the commander's intent and proactively developed engineering support plans to manifest the commander's intent.

Command and Control: The agility of OIF-F command and control was not agile. While innovative ideas enabled new possibilities, it took time to implement those ideas. It takes time to develop an ability to plan general engineering projects with a combat engineering headquarters. It takes time to assess the tasks required to command and control fight as infantry missions. It takes time for combat engineering officers to review

the details of designing a base camp. Even for units that transitioned from deployment directly into stability operations had to deal with these same conditions. Units were not resourced to overcome these conditions quickly.

Operational Mobility: The quick response of the 94th Engineer Battalion to the airport mission demonstrates its ability to transition without losing momentum.

Training: Since premobilization training focused on offensive tasks, it did not doctrinally prepare the OIF-F for agile transitions.

Effectiveness

Capabilities: Interview respondents and professional articles indicate that the OIF-F completed the missions it was assigned. Therefore, OIF-F capabilities were effective. However, as the stability phase continued, maneuver commanders requested a quantity of infrastructure repairs that their combat engineering units simply could not provide.

Prioritization: Interview respondents and professional articles did not point to any gross cases of engineer units not supporting the commander's priorities. Even when V Corps directed a number of security missions in Baghdad, engineer commanders followed the higher commander's prioritization and then executed their lower priorities with remaining assets.

Command and Control: Interview respondents and professional articles indicated that engineer units provided strong command and control to their subordinate units.

Operational Mobility: Despite the challenges of limited lift assets, operational mobility in the OIF-F was effective.

Training: While training was highly effective in preparing for the successful offensive fight, it did not doctrinally prepare the OIF-F to meet the requirements of the stability phase.

Efficiency

Capabilities: OIF-F capabilities were not efficient. This is largely a subjective evaluation. The soldiers that provided ad hoc capabilities developed in the OIF-F were less than qualified to perform the tasks to the doctrinal standard.

Prioritization: At each echelon, OIF-F mission prioritization was efficient. Engineer planners were well-integrated into the maneuver unit's planning process, and engineer commanders proactively developed sound plans to support the maneuver commander's intent.

Command and Control: The size of some engineering unit areas of operations was a significant challenge to both the doctrinal and ad hoc command and control structures of the OIF-F. Additionally, the planning and control requirements of the general engineering and fight as infantry missions were outside of the unit's doctrinal mission set. These ad hoc solutions accomplished the mission, but it took longer and yielded a less optimal solution than a doctrinally appropriate solution.

Operational Mobility: OIF-F operational mobility solutions were efficient. The mission modules optimized the location of scarce organic lift, and the general engineering unit leaders articulated their operational lift shortfalls to their maneuver commanders.

Training: OIF-F premobilization training was not efficient. While it was responsible for the overwhelming success of offensive operations, it did not prepare engineer units for the uncertainties of the stability phase.

OIF-F solutions were versatile and effective, but lacked responsiveness, agility, and efficiency. Innovative solutions overcame identified challenges. However, tasks were not performed to the doctrinal standard.

## The Future Engineer Force Solution and Evaluation

The reader must recognize two assumptions that enable this portion of the analysis. At the time of this writing, the FEF design has not received final approval for implementation. The analysis assumes that currently available draft documents and information can sufficiently model the capabilities of the FEF. The analysis also assumes that the FEF would have deployed roughly the same composition of forces that were actually deployed to fight OIF and transition into stability operations. This enables an "apples to apples" comparison of OIF-Force and FEF solutions to identified OIF challenges. Both 3rd (United States) Infantry Division (Mechanized) and 1st (United States) Infantry Division (Mechanized) had their three organic mechanized combat engineer battalions, an attached corps combat battalion, and an attached corps construction engineering unit for a total of five battalions. Under the FEF rules of allocation, an engineer brigade can be allocated once the number of engineer battalions reaches five. That would put a modular engineer brigade headquarters in both 3rd and 1st Infantry Division. 3rd Armored Cavalry Regiment had its organic engineer company, an ordinance company (Explosive Ordinance Disposal), and an attached combat engineer

battalion from corps, and a reserve component engineering construction unit. Figure 14 shows the modular task organization:

| Parent Unit | Organic/ Attached Engineer Unit |
|---|---|
| UEx 3ID | 1 each modular engineer brigade headquarters<br>4 each modular combat effects battalions<br>1 each modular construction effects battalion |
| UEx 1ID | Same as above |
| 3rd Armored Cavalry Regiment | 1 each modular combat effects battalion<br>- 1 each BCT mobility support company<br>- 1 each explosive hazards detachments (including 5 explosive hazard teams) |

Figure 14. Modular Task Organization

The modular task organization depicted in figure 14 should meet the challenges identified in this thesis by providing (1) more capabilities than similarly-sized OIF-force units, (2) an inherent modular structure that embraces tailored formations, (3) a more robust engineering planning staff at the theater and operational/ tactical levels, and (4) a revolutionary communications systems. The succeeding chapters will describe how the identified task organization could address the OIF challenges.

Grouped by Challenge Categories

Capabilities

For a number of reasons described earlier in this chapter, the OIF-F deployed into theater with insufficient capabilities to meet the requirements of stability operations--particularly general engineering requirements. The modular task organization in figure 14 would arrive on the battlefield with organic general engineering expertise. First, the technical section of the engineer brigade headquarters contains four organic survey and

design teams that can plug in to subordinate engineering staff headquarters. This inherent general engineering capability would have enabled an earlier, more orderly, and more thorough assessment of Baghdad's infrastructure when the 3rd Infantry Division's engineer brigade was sent to "turn on the lights" in Baghdad. Secondly, each survey and design team has embedded ability to video tele-conference with USACE experts within the continental United States for additional expertise. The FEF will have better-trained experts to send into theater.

FEST teams that deploy to support such operations will habitually train with the USACE districts. This enables the FEST teams to more fully understand the depth and breadth of support that USACE offers to the warfighting commander. Those same USACE districts are also working to perfect the SWEAT operations born during OIF, although this is more as a lesson learned then as a specific transformation initiative of the Engineer Regiment. Finally, the increased number of military police and infantry soldiers in the Modular Army should reduce the need for engineers to perform fight as infantry missions. FEF command and control introduces additional force multipliers.

<u>Prioritization</u>

Without a lieutenant colonel engineer commander in the brigade combat team, there is a risk of the brigade's organic engineering companies being employed inefficiently, losing training proficiency, or focusing too heavily on fight as infantry missions. Engineering "battalions without [an engineering] brigade get penny packeted out and dribbled away" (Toomey 2005).

However, a potential prioritization strength of the Modular Force is the elimination of one echelon of command. Instead of corps commanders "thinking two

levels down" (U.S. Army 2004d) the UEx commander provides his visualization directly to the executing echelon. This enables a more unified prioritization across all echelons.

Command and Control

Technology and design combine to give the FEF powerful command and control potential. Revolutionary improvements to the communications networking infrastructure enable engineering reconnaissance teams to transmit more detailed descriptions of potential work sites. The provides better anticipation of requirements, more precise tailoring of requirements, and better tailoring of capabilities packages with less lead time. In short, communications improvements enable better campaign planning. Better execution can result from the more robust staffs and command posts of the modular engineer battalions and brigade. Each battalion and brigade has a main command post, two deployable command posts, and a separate mobile command post for the commander. While these enhancements significantly improve engineering responsiveness on the battlefield, the modular brigade combat team itself is lacking in organic engineering staff and capabilities. An engineer company is embedded in each of the heavy brigade combat team's maneuver battalions, a major serves as the senior engineering for the brigade, and there is no engineering field grade commander to articulate engineering requirements to the brigade combat team commander. The majority of engineer brigade, group, and battalion commanders interviewed for this thesis emphasized the costs of not having a lieutenant colonel commander organic to the brigade combat team. The lack of an organic engineer commander can impact prioritization of engineering support.

Operational Mobility

The two major operational mobility challenges in OIF were that: (1) many specialty units were too small to move around the battlefield independently, and (2) construction units had to compete with tanks and armored personnel carriers for lift assets. The FEF addresses one of these issues by providing organic lift to construction units and through better management of small units in the modular structure.

Training

The fundamental training challenge was that engineer units focused almost exclusively on offensive mobility tasks prior to OIF and were not prepared for the stability phase. The FEF reduces the scope of required training by focusing each modular unit on a small skill set. Breaching modules focus training on breaching minefields. Tank-launched bridge units focus on launching bridges. While this enables a higher proficiency on more tasks as well as more time for stability operations training, it potentially reduces unit flexibility. When engineering Soldiers and leaders are limited to certain specialty mission sets within the Engineer Regiment, it is more difficult to train them on the Regiment's broader capabilities later in their careers or in the midst of a contingency operation.

## Comparison of Future Engineer Force and Operation Iraqi Freedom Force

Organized by Evaluation Criteria

Responsiveness

Capabilities: The FEF structure provides general engineering units that are more doctrinally appropriate for the stability mission in OIF. Additionally, the larger

proportion of military police and infantry units should reduce the demand for engineering fight as infantry missions.

Prioritization: The organic engineer commander in each maneuver brigade fosters a better relationship between the combat engineer commander and the maneuver commander. This enables the engineer commander to have a better idea of how that particular commander and unit fights, how a particular maneuver develops and articulates the commander's intent, and how to support that commander.

Command and Control: The more robust battalion and brigade staffs of the FEF can inherently plan and control general engineering operations better than the OIF-F. The expanded intelligence sections also make the FEF better suited to planning and controlling fight as infantry missions. However, such missions will still require doctrinal reconfiguration and augmentation.

Operational Mobility: The organic operational lift of FEF general engineering units makes it more operationally mobile than the OIF-F.

Training: The FEF training concept provides the Engineer Regiment with a better depth and breadth of trained engineering capabilities than does the OIF-F. Each individual unit can perform fewer tasks, but there is a wider array of specialized units that provides an assortment of trained skills.

### Versatility

Capabilities: The modular focus of the FEF results in a wider range of trained capabilities than the OIF-F could produce. The FEF is better suited to fulfill foreseen requirements than the OIF-F.

Prioritization: There is no significant difference in the ability of these two organizations to provide versatile mission prioritization.

Command and Control: The FEF's more robust battalion and brigade staffs enable it to adapt to unforeseen requirements better than the OIF-F.

Operational Mobility: The organic lift of FEF general engineering units provides FEF headquarters with more options than the OIF-F headquarters.

Training: OIF-F training better prepares individual units to adapt to unforeseen requirements outside of the doctrinal skill set. The narrow training focus of each FEF unit does not foster the type of multifunctional adaptation demanded during OIF stability operations.

Agility

Capabilities: The FEF is better suited to transition between and within operations than the OIF-F. The OIF-F transition involved significant ad-hoc reorganization with borrowed equipment and no training. The FEF is designed to reorganize to meet changing missions and is better resourced for this task.

Prioritization: The lack of an organic engineer commander in each brigade will potentially inhibit the ability of FEF to transition without losing momentum. Lack of familiarity with unit standard operating procedures and battle drills may create obstacles that the OIF-F did not face.

Command and Control: See discussion on capabilities above.

Operational Mobility: Organic operational lift provides the FEF more agility than the OIF-F.

Training: In comparison to OIF-F premobilization training, FEF training provides engineer units with the competencies and skills to overcome the anticipated requirements of operational transitions.

Effectiveness

Capabilities: The FEF provided better capabilities than the OIF-F. It is more effective.

Prioritization: The OIF-F optimizes the human factor of commander interaction. Its prioritization effectiveness is superior to that of the FEF.

Command and Control: The FEF provides better command and control capabilities that the OIF-F. It is more effective.

Operational Mobility: The FEF provides more organic lift than the OIF-F. It is more effective.

Training: The individual unit training focus of both the FEF and OIF-F is narrow. In this sense, their training strategies are equally effective. However, for Engineer Regiment, the FEF provides more depth and breadth of skill sets than does the OIF-F

Efficiency

Capabilities: The FEF units that provide capabilities are better trained and experienced than those of the OIF-F. They are also better equipped with more modernized equipment. It is reasonable to expect them to be more efficient in execution.

Prioritization: The OIF-F is more efficient at prioritizing missions due to the time allotted for relationships to form between the engineering and maneuver commanders.

Command and Control: The two deployable tactical command posts and mobile command group inherent at the battalion and brigade level enable the FEF to exercise command and control over greater distances than the OIF-F force.

Operational Mobility: The improved organic lift capabilities of the FEF make its operational mobility more efficient than that of the OIF-F.

Training: The FEF does a better job of providing trained units for a wider number of skill sets than does the OIF-F. It is more efficient in producing capabilities. See figure 15.

**OIF-F to FEF Comparison Results**

**Evaluation Criteria**

| Challenge Categories | Responsive-ness | | Versatility | | Agility | | Effective-ness | | Efficiency | |
|---|---|---|---|---|---|---|---|---|---|---|
| | OIF-F | FEF | OIF-F | FEF | OIF-F | FEF | OIF-F | FEF | OIF-F | FEF |
| Capability | + | - | + | - | + | - | + | - | + | - |
| Priority of Support | - | + | ~ | ~ | - | + | - | + | - | + |
| C2 | + | - | + | - | + | - | + | - | + | - |
| Operational Mobility | + | - | + | - | + | - | + | - | + | - |
| Training | + | - | - | + | + | - | + | - | + | - |

+ stronger performance than that other force; weaker performance than the other force; ~ tie in performance

Figure 15. Operation Iraqi Freedom Force to Future Engineer Force Comparison Results

Chapter 4, “Analysis,” described the primary challenge the Engineer Regiment faced in supporting OIF. It described the five broad subordinate challenges and explained how the OIF-F faced those challenges. It explained that FEF solutions to OIF challenges are better than OIF-F solutions to those challenges. Chapter 5, “Conclusions and Recommendations,” will present the implications of these conclusions.

# CHAPTER 5

# CONCLUSIONS AND RECOMMENDATIONS

## Introduction

Chapter 4, "Analysis," compared the strengths and weaknesses of the FEF and the OIF-F. The purpose of this chapter is to present the conclusions of this comparison and the recommendations for further research. Although the analysis indicates that FEF transitions are more responsive, versatile, agile, effective, and efficient than OIF-F transitions, it also shows there is room for improvement in FEF mission prioritization and training. This chapter will focus on four themes. First, an FEF-equipped Engineer Regiment is better equipped to handle OIF challenges than was the OIF-F. However, the lack of an organic engineer commander in the brigade combat team presents significant risks. Additionally, the more narrow training focus of each FEF unit presents another significant risk. Finally, this thesis recommends five areas for further study.

## Conclusions

The FEF is better suited than the OIF-F to overcome OIF challenges. The FEF is more responsive. It provides more organizations with skill sets appropriate to the general engineering challenges of OIF. It is more versatile. Once in theater, FEF organizations can respond to a wider range of missions before employing ad-hoc solutions. It is more agile. The modular organization can enable faster task organization changes with less turbulence. It is more effective and efficient. FEF forces are better suited to meet OIF challenge requirements with less on-the-job training. Along with these strengths, the FEF has significant weaknesses.

The lack of an organic engineer commander in the brigade combat team presents risks to engineering mission prioritization and commander training. First, the engineering and maneuver commanders must learn to quickly establish a relationship of trust and form a cohesive combined arms team in a short period of time. While this relationship is forming, there is a real potential for suboptimal understanding of the commander's intent that can lead to inefficient mission prioritization. Second, The Engineer Regiment must develop ways to train the maneuver commander to employ the capabilities of a modular engineering organization. Without a habitual relationship with an engineer commander, maneuver commanders may not fully comprehend the capabilities of the Engineer Regiment. The regiment must also train engineer commanders to efficiently support maneuver commanders that they will not have habitual contact with.

The more narrow training focus of each FEF unit presents a risk to FEF versatility. While a more narrow training set for each unit increases depth of training mastery, it does not favor the multifunctional capabilities demanded by a versatile engineering regiment. Given the unpredictable nature of the COE, units must be prepared to innovatively adapt to unanticipated missions outside of their doctrinal skill set. Narrowly trained units will find themselves outside their doctrinal skill set more often the widely trained units.

To overcome another versatility risk, the Engineer Regiment must determine better solutions for preparing engineer units to fulfill the fight as infantry role. Despite the larger proportion of MP and infantry units in the Army's Modular Force, it is reasonable to expect a continued requirement for engineer units to fight as infantry.

Doctrinal reorganization is often too costly in time or resources to be practical. This shortfall needs to be compensated for in unit training strategies.

The breadth of skill sets in the Engineer Regiment poses a versatility risk in the way of expertise. The OIF-F experienced shortages in general engineering expertise. Current technology does not support the use of tele-engineering as a solution to battalion-level general engineering expertise shortages. Low-bandwidth solutions need to be developed to address such battalion-level shortfalls. Also, engineering leaders must be confident in their ability to employ the wide array of combat, general, and geospatial capabilities available in the Engineer Regiment. The breadth of skill sets in the regiment requires engineering leaders to master as many skills as feasible and to know where to go to address their own personal shortfalls.

## Recommendations

This thesis recommends further study of: (1) comprehensive OIF-F effectiveness and efficiency, (2) the relationship between engineering and maneuver commanders, (3) how to produce a multifunctional unit, (4) more precise linkage between assured mobility and FEF structure, and (5) how to better integrate and interagency capabilities.

The Engineer Regiment needs more comprehensive determination of OIF-F effectiveness and efficiency. While there is a wealth of articles and after-action reviews on OIF, the Engineer Regiment needs to publish more comprehensive analyses of OIF stability operations.

There is also a need for further inquiry into the relationship between engineer commanders and maneuver commanders during OIF. Interactions between engineering and maneuver commanders are an important part of warfare’s human element. Since the

FEF will likely change this relationship, its implications and mitigation measures warrant attention.

More attention is also needed in determining how to achieve a multifunctional capability--the ability to develop untrained capabilities in theater. General engineering and fight as infantry skill sets were required in a short period of time. Since so many units experienced this requirement, best practices should be compiled, explored, and perhaps codified into doctrine.

The Engineer Regiment would benefit from a more precise linkage between assured mobility and the structure of the FEF. While the concept has been in use for at least two years, it is still not widely understood in the opinion of this researcher.

The infrastructure challenges met by the OIF-F were the purview of other agencies within the United States government. While interactions with these agencies continued to steadily improve infrastructure, better and earlier integration of interagency solutions may have brought even better results. More study on the Interaction between USACE, Office of Reconstruction and Humanitarian Assistance, United States Agency for International Development, Central Command, and Combined Joint Forces and Land Component Command Iraq between March 1993 and today could yield important lessons for future contingency operations.

# GLOSSARY

Agility. An attribute of strategically responsive Army units and a tenet of Army operations; A responsive, agile force package is one that is sustainable and mobile enough to accomplish the mission. Agile forces are mentally and physically able to transition within or between types of operations without losing momentum. Mentally agile commanders, staffs, and Soldiers adapt force packages, strategies, and tactics to mission requirements in dynamic environments. (FM 3-0)

Allocation. (DOD) In a general sense, distribution of limited resources among competing requirements for employment. Specific allocations (e.g., air sorties, nuclear weapons, forces, and transportation) are described as allocation of air sorties, nuclear weapons, etc. See also apportionment. See FM 100-12.

Apportionment. (DOD) In the general sense, distribution for planning of limited resources among competing requirements. Specific apportionments (e.g., air sorties and forces for planning) are described as apportionment of air sorties and forces for planning, etc. See also allocation. See FM 100-12.

Area of operations. (DOD) An operational area defined by the joint force commander for land and naval forces. Areas of operations do not typically encompass the entire operational area of the joint force commander, but should be large enough for component commanders to accomplish their missions and protect their forces. Also called area of operation.

Army's modular force. The Army term used to describe the land fighting force fifteen to twenty years into the future; represents continual improvement, therefore the Army will never achieve the Army's Modular Force standards; as the force improves toward those standards, designers will continue to look further into the future to determine the next mission set the Army must meet

BCT/UA. The brigade combat team or unit of action; contains two heavy maneuver battalions and necessary force multipliers. it is the centerpiece of the Army Army's Modular Force

BTB. Brigade troops battalion; the BCT/UA organization that modular forces "plug and play" into; it is the link between the BCT/ UA and non-organic units

Capability. The capacity to be used, treated, or developed for a specific purpose (Houghton Mifflin Company 2002).

Combatant commander (COCOM). Used here to refer to the commander of a regional combatant command: (DOD) A unified or specified command with a broad continuing mission under a single commander established and so designated by the President through the Secretary of Defense and with the advice and assistance of the Chairman of the Joint Chiefs of Staff. Combatant commands typically have geographic or functional responsibilities. See FM 3-0.

Command and control. FM 6-0 (Battle Command) Command and control is the exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of a mission. Commanders perform command and control functions through a command and control system.

Contemporary operating environment. The contemporary operating environment; term used to describe the nature of today's battlefield that includes weapons of mass destruction, failed or failing states, world globalization, the presence of non-state actors, and the increasing threat of international terrorism

CONUS. The forty-eight contiguous states of the United States America (i.e. not including Alaska and Hawaii)

COSCOM (corps support command). The army organization that provides logistic support to a corps organization.

Current force. The Army's term to refer to today's fighting force (see Army's Modular Force)

Effectiveness. The ability of a force or operation to accomplish the mission by achieving the intended or expected effect (author defined)

Efficiency. The ability of a force or operation to achieve effectiveness with a minimum of waste, expense or unnecessary effort (author defined)

Future Engineer Force. The Army term used to describe the Engineer Regiment that will support the Army's Modular Force; the Future Engineer Force represents continual improvement, therefore the regiment will never achieve the Future Engineer Force standards. as the force improves toward those standards, designers will continue to look fifteen to twenty years into the future to determine the next mission set the Engineer regiment must meet

HMMWV. High Mobility Multipurpose Wheeled Vehicle

Line haul assets. Truck-pulled trailers that capable of carrying tanks and other tracked vehicles long distances in order to reduce the unnecessary wear that long road marches place on tracked vehicles

Maneuver enhancement brigade. The Army's Modular Force organization that combines engineering, military police, and chemical units to execute shaping operations for the commander.

Offensive operations. Operations which aim at destroying or defeating an enemy. purpose is to impose US will on the enemy and achieve decisive victory. (FM 3-0)

Operational mobility. The ability of a force to move quickly within a theater of operations

"Plug and play." The capability of modular forces to seamlessly integrate into a higher unit or headquarters with whom they have no habitual relationship

Priority of support. Priorities set by the commander in his concept of operations and during execution to ensure combat support and combat service support are provided to subordinate elements in accordance with their relative importance to accomplishing the mission (FM 1-02)

Responsiveness. An attribute of strategically responsive Army units; requires that the right Army forces: those the JFC needs to deter an adversary or take decisive action if deterrence fails--deploy to the right place at the right time; emphasizes training, planning, and preparation for deployment (FM 3-0)

Stability operations. Operations that promote and protect United States interests by establishing or maintaining regional stability and averting the requirement for and potentially damaging effects of major combat operations

Strategic mobility. The ability of a force to deploy from home station or from one theater of operations to another theater of operations

Support UA. One of the many brigade- sized Army's Modular Force organizations that support the BCT/ UA

Sustainment UA. A brigade sized Army's Modular Force organization that provides sustainment to a BCT/ UA, unit of employment x, or unit of employment y

Theater of operations. The geographical boundaries surrounding a potential area of armed conflict involving United States forces

Theater. (DOD) The geographical area outside the continental United States for which a commander of a combatant command has been assigned responsibility. See FM 3-0.

Training. The means to achieve tactical and technical competence for specific tasks, conditions, and standards (FM 7-0, iv). It is the process that melds human and materiel resources into these required capabilities. (FM 7-0 2003, 1-1).

Unit of employment x. Unit of employment “x”; one of two Army’s Modular Force headquarters organizations; capable of providing command and control of up to five UAs (units of action)

Unit of employment y. Unit of employment “y”; one of two Army’s Modular Force headquarters organizations; provides command and control to one or more unit of employment x elements, organic subordinate organizations, and other joint, multinational, and interagency organizations.

Versatility. An attribute of strategically responsive Army units and a tenet of Army operations; the ability of an Army force package to reorganize and adapt to changing missions. Requires careful tailoring and sequencing forces into theater and making sure forces have the necessary command and control, combat, CS, and CSS assets; encourages commanders to deploy multifunctional teams and to conduct home station training that emphasizes teamwork and adaptability. Commanders stress versatile command and control and practice reconfiguring headquarters to control multiple missions.

# APPENDIX A

## WALLACE INTERVIEW SUMMARY

This appendix presents the questions posed the LTG William Wallace during the 40-minute interview on 19 January 2005. Responses are summarized after the question list.

1. Purpose: The purpose of this information paper is to prepare the reader to be interviewed as a source for a Master's of Military Arts and Science (MMAS) thesis paper.

2. Thesis question: The MMAS thesis of this paper is, "Does the Future Engineer Force transition engineering forces between major offensive and stability operations in ways that achieve responsiveness, versatility, agility, effectiveness, and efficiency.

3. Interview focus: This 45-minute interview will focus on capabilities of combat and construction engineer units in Operation Iraqi Freedom (OIF), command and control of separate brigade and smaller units during Operation Iraqi Freedom and the flow of units during reception, staging, onward movement, and integration (RSOI). Particular emphasis will be given to combat and construction engineers in each of these three areas.

4. Interview questions: Below are questions that will be posed.

a. Combat and construction engineering unit capabilities

(1) What were the three most important capabilities that combat and construction engineer units provided to corps and division commanders during OIF?

(2) What mix of combat and construction engineer units would have best support a mechanized infantry division commander during major offensive operations in OIF?

(3) What mix of combat and construction engineer units would have best supported a mechanized infantry division commander during stability operations in OIF?

(4) At what critical times and locations during OIF did combat or construction engineering requirements not match capabilities (either too much or insufficient capability)?

(5) How did division commanders respond when the engineering unit available for the mission was not doctrinally suited for the mission (i.e., when construction engineers were required but combat engineers were all that was available)?

b. Command and control of brigade and smaller elements during OIF

(1) How did V Corps determine the appropriate initial and subsequent command and control of brigade and smaller elements without an organic parent HQ?

(2) Typically, who provided sustainment to brigade and smaller elements as they moved between intra-theater areas of operation?

(3) Typically, how quickly and efficiently did the “logistics tail” (deadlined vehicles, etc.) left in the old intra-theater AO move to the new intra-theater AO?

c. Strategic and operational mobility

(1) Do “legacy” army units (particularly combat and construction engineer units) have the strategic mobility to quickly move into theater?

(2) How long did it typically take for an army battalion (of any type) to complete the reception stage of RSOI?

(2) Where in theater did V Corps typically stage army units (particularly combat and construction engineer units) that were waiting to be employed.

(3) Did transitions between major offensive and stability operations in during OIF happen over a matter of hours, days, or weeks?

(4) How much did V Corps rely on sister services for engineering support during OIF.

5. Special request: This interview will be either taped in order to enable accurate recording of responses.

Summary of Interview Responses

| OIF Challenges | Solutions Employed in OIF |
|---|---|
| **<u>CAPABILITIES</u>:**<br>**It's about campaign planning, not force structure**<br>**Obstacle Reduction**<br>**River Crossing Operations**<br>**Level of engineer work required as a result of Saddam's lack of infrastructure maintenance was massive and unanticipated. Most engineer work, tasks, and big projects were more emergent than planned** | **130th Engineers were the V Corps Engineers**<br>**- Integral to all planning efforts for the corps**<br>**- Terrain teams to visualize**<br>**- Advice on how to best employ the engineers**<br>**- Did very detailed work estimates on assault crossings, locations and positioning of bridge companies in formations, who they'd be attached to for movement in particular**<br>**- Also recognized engineer work to be done primarily in improving facilities enroute;**<br>**- Recognized engineer work needed to be done in improving facilities enroute—specifically selected LOG SUPPORT AREA for BUSHMASTER outside of Najaf because it was near an unimproved dirt airstrip;**<br>**Obstacle Reduction capability was inherent at 3ID**<br>**Wargaming identified potential gap crossing requirements:**<br>**- West of An Nassari**<br>**- Well past Karbala gap across Euphrates the second time around obj peach; potentially had to get well to west to Ramada-Fallujah highway 10 approach from west to east**<br>**- Assumed that Iraqis would demo the bridges**<br>**Subordinated engineer groups to the 130th Engineer Group**<br>**Identify tasks to be accomplished, in what sequence, ensure capability was embedded as we moved forward**<br>**Up front work to assess infrastructure of regime change target country**<br>**Look for opportunities to employ the engineers you have:**<br>**- Tikrit: bridge over Tigris River was 85 bays, 2.5 bridge companies, longest float bridge put in by any engineer unit**<br>**- Mosul: Kurdish party leader requested repair of bridge apparently bombed by USAF; engineers put in a Baily and reestablished that bridge largely for commercial purposes**<br>**D9 Dozers: anticipated for urban operations; also useful for clearing airfields** |
| **<u>COMMAND AND CONTROL</u>**<br>**Emergent missions needing tailored solutions** | **Breaching inherent at tactical level**<br>**Engineers subordinated to 130th Engineer Group**<br>**Matching from campaign plan perspective means looking at requirements and sequence of operations and then embedding that capability in the force**<br>**Frontloaded engineers to upgrade airstrip for UAV and C130 as early as possible in the campaign**<br>**Put specific capabilities with particular organization to get berming for force protection**<br>**Corps TAC CP had associated engineer ability**<br>**Adapted very well to emergent missions**<br>**- Little to do with standard C2 structure, architecture, or hierarchy of units**<br>**- difference between tactical command and technical command/ technical coordination**<br>**- Technical channels are available**<br>**- Authority to chop assets to get task done**<br>**Construction of basecamps in Kuwait before LD: oversee Kuwaitis and also emplace force protection and berms**<br>**Breaching of Kuwaiti/ Iraqi defensive positions going into Iraq: Kuwaiti contractors supervised by 130th Engineers (berms, tank ditches, wire concertina obstacles, chain link fences, series of observation towers on both sides; Coalition engineers filled in the tank ditch and breached wire obstacle on other side; then became marking drill; didn't know if Iraqi side was mined**<br>**MSR Maintenance: dust was a problem**<br>**Airfield at An Najaf:** |

| | |
|---|---|
| **PRIORITIZATION:** | **Number of requirements**<br>**Location of units and capabilities (bridge crossings)**<br>**Improving facilities enroute (chose Bushmaster for proximity to airstrip)**<br>**- Frontloaded engineers to make it usable early**<br>**Berming for TAC CP** |

APPENDIX B

SWEAT OPERATIONS METRICS

## Execution Challenges: Utilities Infrastructure Intel

- Iraqi Map-reading skills
- Understanding the City and National Grids
- Engr Bns recon/assess facilities in their AO's
- Engr Bns ID materiel sources (repair parts, etc.)
- Security to Move
- Security of facilities
- Massive UXO/ CL V; limited EOD
- Steadily increasing threat over time

- Several Water and power key nodes out of 3ID sector
- ORHA arrival, role, and RIP
- Iraqi Officials' authority

***MARNE SAPPER!***

## Gathering Intel: Facility Status Report

| Site | MGRS | Status | Remarks |
|---|---|---|---|
| | | | |
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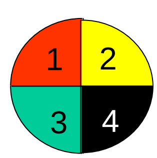
| | | | |

1. Damage
- Fully Functional
- Minor Damage
- Severe Damage
- Completely Destroyed

3. Secure Area
- Area completely secure
- Civilian interference
- Probable enemy contact
- Encountered enemy contact




2. Operators
- Operator on hand
- Operator located
- Have operator name
- No name or contact

4. Projected Timeline
- Completed < 3 day
- Completed < 7 day
- Completed < 14 day
- Completed < 30 day

## POWER

| Power Station | Fuel Source | Maximum Output | Total Running | Remarks |
|---|---|---|---|---|
| Hemrien | Hydro | | 50MW | |
| Kirkuk | Gas | 245MW | 70MW | |
| Qudas | Thermal/tanker only | 10-40MW @ | 140MW | Built 2002 under commission |
| Baghdad South | Thermal/Gas | 315MW | 115MW | |
| Doura | Thermal/Gas | 780MW | 105MW | two units Rehab/ 1 under const. |
| Tadji | Gas | 245MW | 0 | capable of 90MW |
| Al Musiab | Thermal | 400MW | 0 | |
| Hadithih | Hydro | | 200MW | |
| Mashtel | Thermal | 10MW | 230MW | |
| Bayji | Thermal/Gas | | 100MW | |
| Mosul | Hydro | | 100MW | |
| Total | | | 1110 (65%) | 1700MW average daily load |
| | Rule of thumb 1MW=1000 homes or equivalent industrial use | | | |

## WATER

| Site | Priority | Serves | Power Req. MW | Grid or ER Gen | Remarks |
|---|---|---|---|---|---|
| SABA NISSAN WTP | 1 | East - Entire System | 12 | Grid | Partial power, 3 Gen down, Q=100MLD now, goal 140MLD |
| WATHBA WTP | 2 | East - Rusafa | 2 | ER Gen | No grid power |
| ABU NAWAS RWPS | 3 | East - Al Wiyah | 4 | - | No Power at all |
| ALWAHDA WTP | | East - | 2 | Grid | |
| AL RASHED WTP | | East - | 2 | ER Gen | Frequent shutdowns from Grid, thus ER Gen |
| UBAIDY RES | | East - | 1.5 | ER Gen | |
| KAMALIA RES | | East - | 1.5 | ER Gen | |
| AMIN RES | | East - | 1.5 | Grid | with residential area |
| RUSTMIYA RES | | East - | 1.5 | - | No power at all, UXO Hazard Loc TBD |
| | | | | | |
| NORTH KARKH RES | 1 | West - Karkh North | 6 | Grid | TOP Priority as of 23 Apr for getting power |
| SOUTH KARKH RES | 2 | West - Kark South | 3 | ER Gen | TOP Priority as of 23 Apr for getting power |
| KARAMA WTP | 3 | West - Inner Karkh | 5 | ER Gen | TOP Priority as of 23 Apr for getting power |
| KARKH WTP | 4 | West - Entire System | 20 | Grid | Partial power, Q=850MLD now, goal 1300MLD |
| DOURA WTP | 5 | West - Doura | 5 | Grid | |
| QADISIYA WTP | 6 | West - | 4 | Grid | Grid started a.m. 23 APR |
| ATYFIYA RWPS | 7 | West - | 3 | - | No Power at all |

**WTP = Water Treatment Plant**
**RES = Reservoir**
**RWPS = Raw Water Pump Station**

SEWER

| Site | Priority | Serves | Power Req. MW | Grid or ER Gen | Remarks |
|---|---|---|---|---|---|
| RUSTMIYA STP - 3 | 1 | East - | 6 | none | Security reqd, main facility for SE Bagh., workers return tomorrov |
| RUSTMIYA STP - 0, 1, 2 | 2 | East - | 4 | none | |
| HABIBIA SPS | 3 | East - | 4 | ER Gen | UXO hazard location TBD |
| NISSAN SPS | 4 | East - | 0.5 | Grid | |
| MANAMA SPS | 5 | East - | 0.5 | Grid | |
| TS1 SPS | 6 | East - | 1.5 | Grid | |
| TS2 SPS | 7 | East - | 1.5 | ER Gen | |
| DHUBAT SPS | 8 | East - | 0.5 | Grid | |
| NIAIERA SPS | 9 | East - | 1 | Grid | Grid Power Not Continous But Partialy Powered |
| HINDIYA SPS | 10 | East - | 0.5 | Grid | |
| GAZALI SPS | 11 | East - | 2 | ER Gen | |
| ALMAJMA SPS | 12 | East - | 0.5 | Grid | |
| T1 SPS | 13 | East - | 3 | ER Gen | |
| | | | | | |
| KARKH STP | 1 | West - | 4 | None | |
| DOURA SPS | 2 | West - | 5 | Grid | |
| PN SPS | 3 | West - | 8 | ER Gen | |
| QADISIYA SPS | 4 | West - | 2 | Grid | |
| N2 SPS | 5 | West - | 1.5 | ER Gen | |
| TC1 SPS | 6 | West - | 1.5 | ER Gen | |
| SHALCHIYA SPS | 7 | West - | 1 | ER Gen | |
| IC2 SPS | 8 | West - | 1 | ER Gen | |
| P2 SPS | 9 | West - | 1 | ER Gen | |
| P3 SPS | 10 | West - | 1 | ER Gen | |
| R2 SPS | 11 | West - | 2 | ER Gen | |
| RQ SPS | 12 | West - | 2 | ER Gen | |
| UM ELDILAL | 13 | West - | 1 | ER Gen | |

**STP = Sewage Treatment Plant**
**SPS = Sewage Pump Station**

*Source*: John R. Peabody, Commander, 3rd Infantry Division Engineer Brigade in OIF in 2003, 2005a, e-mail received by author, 10 March, Fort Leavenworth, KS.

# APPENDIX C

## OIF COMMANDER INTERVIEW QUESTIONS

The following OIF engineering unit commanders were interviewed for this thesis:

| Engineering Unit | Supported Unit | Name |
|---|---|---|
| 555 EN GRP (Combat) | 3rd Infantry Division (Mechanized) | COL Christopher Toomey |
| EN BDE (3ID) | Organic to 3rd Infantry Division (Mechanized) | COL John Peabody |
| 1 EN Bn (Combat Mech) | Organic to 1st Infantry Division (Mechanized) | LTC David Brinkley |
| 54th En Bn (Corps Mech) | 3rd Infantry Division (Mechanized)<br>3rd Armored Cavalry Regiment | LTC Ed Jackson |
| 94th En Bn (Combat Heavay) | 3rd Infantry Division (Mechanized)<br>1st Infantry Division (Mechanized) | LTC Paul Grosskruger |

Below are the questions used for telephonic interviews with OIF engineering unit commanders:

- What were the most significant challenges inherent in supporting OIF offensive operations and stability operations with basically the same force structure?

- What were the most significant challenges inherent in transitioning OIF engineering support between offensive and stability operations?

- If not already described above, what challenges did your organization face in the areas of: capabilities, command and control, prioritization of engineering support, strategic mobility, operational mobility, and homestation training in preparation for supporting both offensive and stability operations?

- What methods were employed in order to overcome the above challenges?

- How does the Future Engineer Force impact the Engineer Regiment's ability to overcome the above challenges?

APPENDIX D

OIF ENGINEER OPERATIONS SURVEY QUESTIONS

Below is the survey given to US Army engineering majors attending the Command and General Staff School at Fort Leavenworth, Kansas. The survey was conducted in April, 2005.

SURVEY: OPERATION IRAQI FREEDOM ENGINEER OPERATIONS
Student Survey, Academic Year 2004-05

Please provide your honest and candid feedback.

**Acronyms used in this survey:**

**USACE**–United States Army Corps of Engineers
**OIF**–Operation Iraqi Freedom
**FEF**–Future Engineer Force
**AOE**–Army of Excellence (the Army most of us grew up in)

1. Please indicate the bye of unit you served in during your OIF tour (CIRCLE ALL THAT APPLY)

| A. | B. | C. | D. | E. |
|---|---|---|---|---|
| Organic Light or Mech Division Unit | Corps Combat Mech/ Wheeled Unit | Construction Unit | USACE or other agency | Did not serve in an OIF deployment |

2. Please indicate the total number of months you served in OIF deployments

| A. | B. | C. | D. | E. |
|---|---|---|---|---|
| 0-6 | 7-12 | 13-18 | 19-24 | Did not serve in an OIF deployment |

3. Please indicate the time frame during which you served in OIF deployments (CIRCLE ALL THAT APPLY)

| A. | B. | C. | D. | E. |
|---|---|---|---|---|
| Before Jan 2003 | Between Jan & Mar 2003 | Between Apr & Dec 2003 | Between Jan & June 2004 | Did not serve in an OIF deployment |

**Use the following response scale unless otherwise directed:**
**(A) Strongly Agree (B) Agree (C) Undecided (D) Disagree (E) Strongly Disagree**

Questions 4 - 7 each use the introductory phrase: "In your professional opinion . . ."

4 _____ combat engineering unit training for the six months prior to OIF focused almost exclusively on offensive mobility (breaching, river crossing, minefield reduction, etc.)

5 _____ there were sufficient general engineering capabilities (construction units, USACE teams, etc.) planned for the OIF stability operations of 2003

6 _____ what percent of engineering missions during OIF stability operations of 2003 were traditional engineering missions (mobility, countermobility, survivability, and construction)?

A. 0-20% B. 21-40% C. 41-60% D. 61-80% E. 81-100%

7 _____ what percent of engineering missions during OIF stability operations of 2003 were "fight as infantry" missions (raids, patrols, cordon & search, etc.)?

A. 0-20% B. 21-40% C. 41-60% D. 61-80% E. 81-100%

Questions 8 - 16 each use the introductory phrase: "In your professional opinion, a significant challenge for <u>DIVISIONAL COMBAT ENGINEERING</u> brigades and battalions during OIF **<u>2003</u>** was . . ."

8 _____ how to meet the engineering requirements for both offensive operations and stability operations with primarily combat engineering units available

9 _____ how to convince decision-makers to put additional general engineering capabilities (engineering construction units and USACE teams) onto the OIF deployment list

10 _____ how to get the right capability, to the right place within theater, at the right time, given the availability of construction units during stability operations

11 _____ how to effectively fight as infantry (patrols, raids, cordon & search), given the training focus of the previous six months,

12 _____ how to restore the electrical, water, and sewage infrastructure to selected cities in Iraq, given the availability of engineering construction units and USACE assets

13 _____ how to determine what infrastructure in Iraq should be repaired first, given the scope of Baghdad's infrastructure damage and lack of infrastructure maintenance

14 _____ how to determine which area of operations would do without engineering construction units, given the availability of construction units during stability operations.

15 _____ how to move special units (EOD, dive detachments, terrain teams, etc.) to needed locations, given that these special units were often times too small to move independently

16 _____ how to conduct stability operations when unit training focused almost exclusively on offensive tasks

Questions 17 - 21 each use the introductory phrase: "In your professional opinion, a significant challenge for <u>CORPS ENGINEER</u> groups, brigades, and <u>CONSTRUCTION</u> battalions during OIF **<u>2003</u>** was . . ."

17 _____ how to responsively move construction units around the battlefield, given the competition for HETs and other vehicle lift assets

18 _____ how to responsively move specialty units to required locations on the battlefield, given the small size of specialty units (EOD, diving detachments, terrain teams, etc.)

19 _____ how to convince decision-makers to put additional general engineering capabilities (engineering construction units and USACE assets) onto the OIF deployment list

20 _____ how to get the right capability, to the right place within theater, at the right time—given the availability of construction units during stability operations

21 _____ how to determine which area of operations would do without engineering construction units, given the availability of construction units during stability operations

Questions 22-27 each use the introductory phrase: "In your professional opinion . . ."

22 _____ OIF challenges in 2003 required combat engineering units to quickly develop general engineering and infantry skills once the stability phase began

23 _____ OIF challenges in 2003 required combat engineering units to reorganize their MTOE units into smaller, mission-tailored units

24 _____ OIF challenges in 2003 required construction engineer units to reorganize their MTOE units into smaller, mission-tailored units.

25 _____ OIF challenges in 2003 required engineer units to develop innovative, non-doctrinal solutions

26 _____ combat engineering units in 2003 executed general engineering missions to standard

27 _____ combat engineering units in 203 executed required fight as infantry tasks (raids, patrols, cordon & search, etc.) to standard

Please answer questions 28 and 29 based on your professional opinion.

28 _____ In hindsight, combat engineering units had sufficient time and notice to improve their general engineering skills prior to the offensive operations phase

29 _____ In hindsight, combat engineering units had sufficient time and notice to improve their "fight as infantry" skills (raids, patrols, cordon & search, etc.) prior to the offensive operations phase

Questions 30-33 each use the introductory phrase: "Based on your knowledge of the Future Engineer Force (FEF) and your professional opinion . . ."

30 _____ increasing the number of infantry and MP soldiers in the Modular Force Army will significantly reduce the requirement for engineers to fight as infantry

31 _____ combat engineering units in the FEF will be proficient to execute the general engineering missions required during OIF

32 _____ engineering construction units in the FEF will be more tailorable to mission requirements than Army of Excellence (AOE) engineering construction units

33 _____ the FEF's training strategy will enable combat engineering units to become proficient on more than offensive operations

**Thanks for your time and comments!**

Survey responses matrix:

| | | Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| Q4 | Count | 1 | 6 | 7 | 1 | 2 |
| | Percent | 6 | 35 | 41 | 6 | 12 |
| Q5 | Count | 0 | 2 | 5 | 10 | 2 |
| | Percent | 0 | 11 | 26 | 53 | 11 |
| Q8 | Count | 4 | 6 | 4 | 1 | 1 |
| | Percent | 25 | 38 | 25 | 6 | 6 |
| Q9 | Count | 5 | 6 | 6 | 0 | 1 |
| | Percent | 28 | 33 | 33 | 0 | 6 |
| Q10 | Count | 5 | 6 | 5 | 1 | 1 |
| | Percent | 28 | 33 | 28 | 6 | 6 |
| Q11 | Count | 3 | 4 | 8 | 2 | 1 |
| | Percent | 17 | 22 | 44 | 11 | 6 |
| Q12 | Count | 7 | 5 | 5 | 1 | 0 |
| | Percent | 39 | 28 | 28 | 6 | 0 |
| Q13 | Count | 10 | 2 | 4 | 1 | 1 |
| | Percent | 56 | 11 | 22 | 6 | 6 |
| Q14 | Count | 2 | 6 | 8 | 1 | 1 |
| | Percent | 11 | 33 | 44 | 6 | 6 |
| Q15 | Count | 2 | 8 | 6 | 1 | 0 |
| | Percent | 12 | 47 | 35 | 6 | 0 |
| Q16 | Count | 1 | 5 | 9 | 3 | 0 |
| | Percent | 6 | 28 | 50 | 17 | 0 |
| Q17 | Count | 3 | 7 | 6 | 2 | 0 |
| | Percent | 17 | 39 | 33 | 11 | 0 |
| Q18 | Count | 1 | 8 | 8 | 1 | 0 |
| | Percent | 6 | 44 | 44 | 6 | 0 |
| Q19 | Count | 5 | 5 | 7 | 0 | 0 |
| | Percent | 29 | 29 | 41 | 0 | 0 |
| Q20 | Count | 5 | 6 | 6 | 0 | 0 |
| | Percent | 29 | 35 | 35 | 0 | 0 |
| Q21 | Count | 3 | 5 | 7 | 2 | 0 |
| | Percent | 18 | 29 | 41 | 12 | 0 |
| Q22 | Count | 5 | 8 | 4 | 1 | 0 |
| | Percent | 28 | 44 | 22 | 6 | 0 |
| Q23 | Count | 2 | 4 | 10 | 2 | 0 |
| | Percent | 11 | 22 | 56 | 11 | 0 |
| Q24 | Count | 1 | 4 | 10 | 3 | 0 |
| | Percent | 6 | 22 | 56 | 17 | 0 |
| Q25 | Count | 8 | 7 | 3 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Percent | 44 | 39 | 17 | 0 | 0 |
| Q26 | Count | 0 | 5 | 12 | 0 | 0 |
| | Percent | 0 | 29 | 71 | 0 | 0 |
| Q27 | Count | 1 | 8 | 8 | 0 | 0 |
| | Percent | 6 | 47 | 47 | 0 | 0 |
| Q28 | Count | 0 | 4 | 8 | 6 | 2 |
| | Percent | 0 | 20 | 40 | 30 | 10 |
| Q29 | Count | 0 | 4 | 9 | 6 | 1 |
| | Percent | 0 | 20 | 45 | 30 | 5 |
| Q30 | Count | 1 | 5 | 4 | 7 | 3 |
| | Percent | 5 | 25 | 20 | 35 | 15 |
| Q31 | Count | 2 | 3 | 6 | 7 | 2 |
| | Percent | 10 | 15 | 30 | 35 | 10 |
| Q32 | Count | 3 | 11 | 5 | 1 | 0 |
| | Percent | 15 | 55 | 25 | 5 | 0 |
| Q33 | Count | 0 | 5 | 15 | 5 | 0 |
| | Percent | 0 | 20 | 60 | 20 | 0 |

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